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EDHEAD

Good times.

I'm beginnging to sound a bit like a broken record, but... damn, I like what we've put together for you this month.

Then again, we're in a lucky spot right now, as there's new tech all over the damn place. This month we've got a round up of all the 79-series AMD cards we've had come through the labs, with some interesting results in terms of what the fastest card is, and on top of that, we're not forgetting the Green Camp, either. Matt Wilson spent a few days in the US recently to get a head-start on NVIDIA's new GTX680, and he's put together a four-page piece on the new Kepler architecture – it's looking pretty promising! No doubt next issue we'll start seeing cards from all the usual suspects.

John Gillooly this month takes his first rather tentative look at the new Z77 motherboard chipset. And to finish the hardware quadrella, Justin Robinson delves into the process of designing motherboards from the drawing board to the production line.

The gaming front is just as packed. We've got in-depth previews of Far Cry 3 (anyone else find Vaas, the poster boy for the game, really scary?), Mists of Pandaria and XCOM: Enemy Unknown, plus a mess of reviews and gaming interviews.

Oh, and there's our thoughts on a little game called Mass Effect 3... you might find that one interesting.

I'm fast running out of space, but before I go, you should also take a gander at the Atomic website – we're producing more news and features there than ever before; we want to make it an important part of your day, so check us out.

See you 'round!

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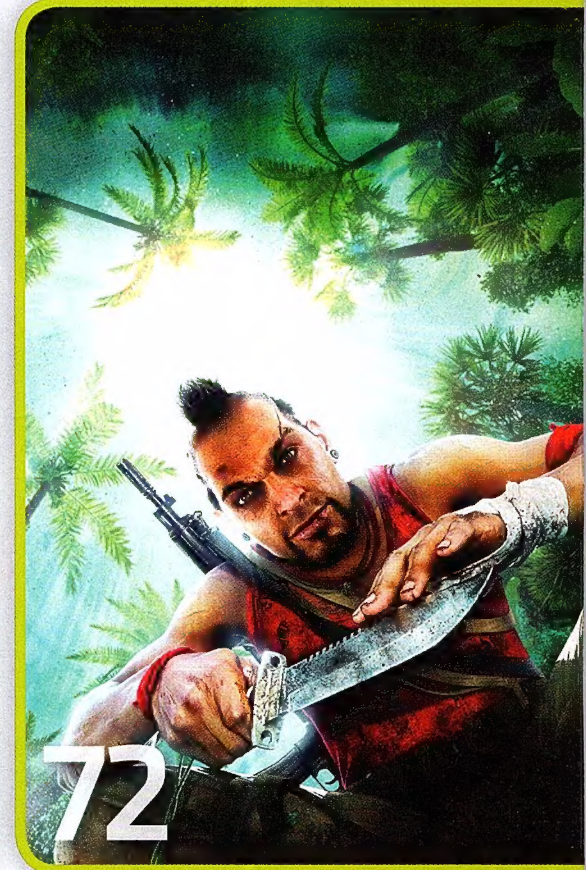

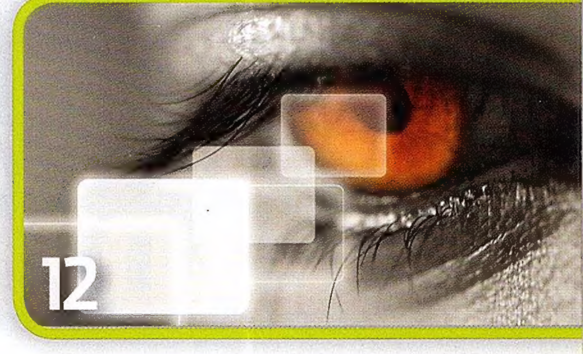

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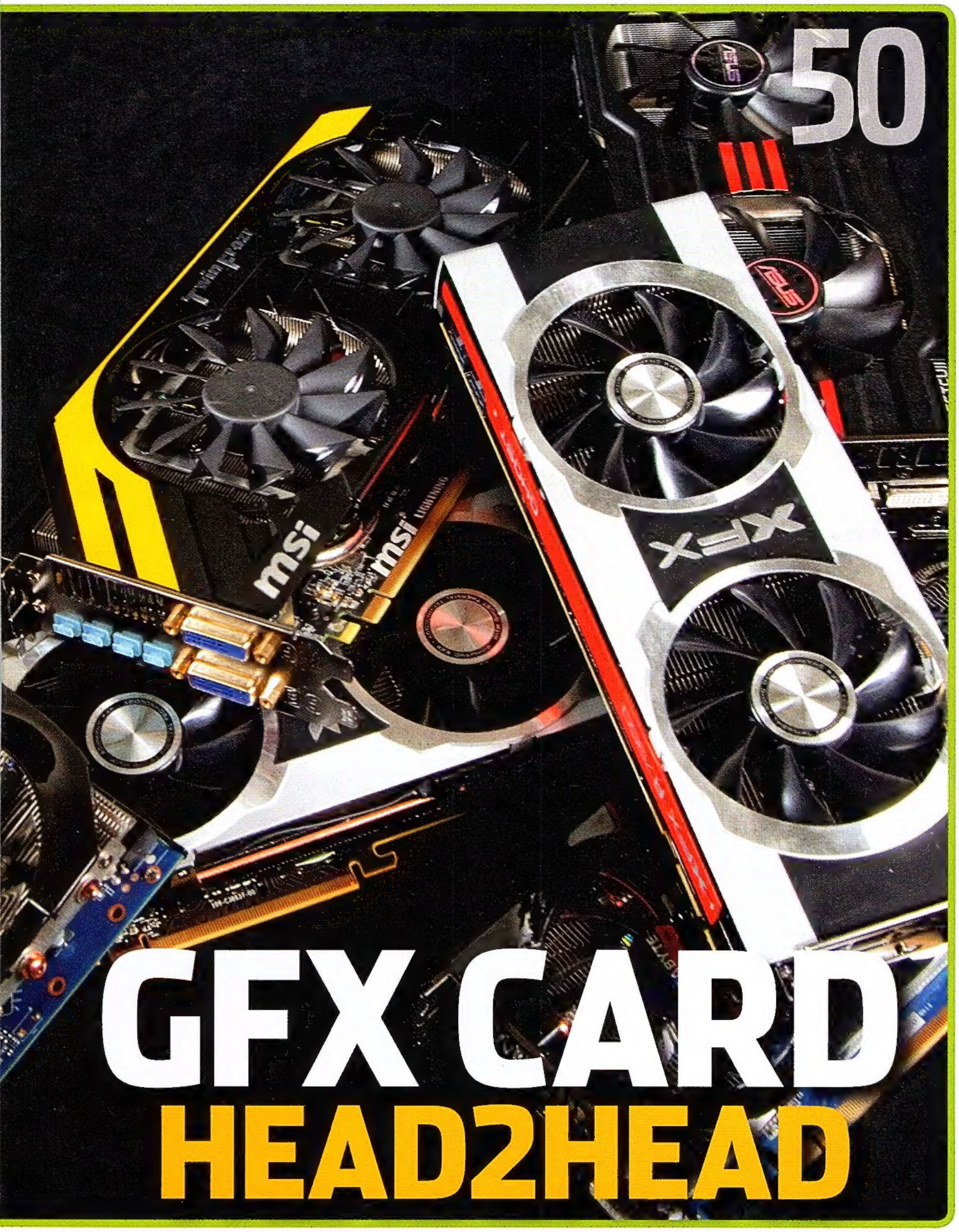

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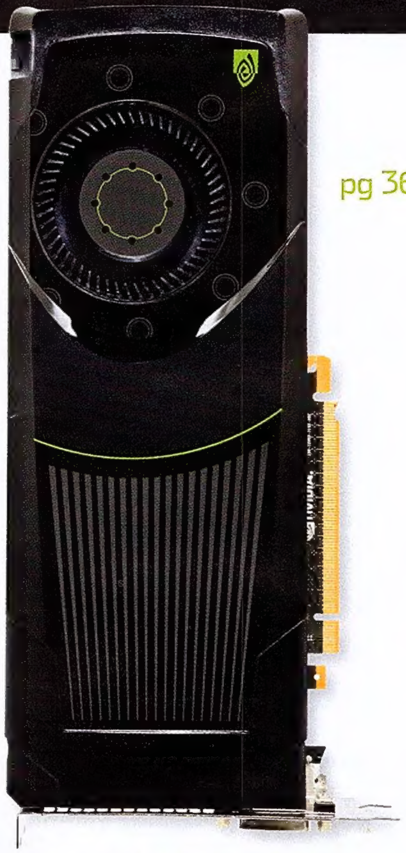

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EQUIP TO DOMINATE

Computex gets ready for 32 consecutive years

June is rapidly approaching, and that means the annual Computex trade show in Taiwan is ramping up for its biggest year to date.

Computex is the most important event on Atomic's calendar each year, next to the E3 trade show. For over a decade we have been making the pilgrimage to Taipei to not only meet with manufacturers, but to also check out the products we expect to see over the coming year.

We attach this importance because Computex is the world's second largest ICT (Information and Communications Technology) trade show, with over 120,000 people expected attend this year. The show itself, which is in its 32nd year, will be running from the 5th until the 9th of June.

This isn't just a show for journalists and tire kickers; it is one of the most important annual events in terms of the PC industry as a whole, with US$28 Billion in revenue expected to be generated this year. A few years ago the show grew so big that a new exhibition centre was built in order to accommodate the number of companies wanting to be part of Computex.

This year's show is going to have four major focuses: Ultrabooks, Smart Handhelds, e-reading and Cloud Services. That isn't to say that the component market is going to be under-represented however, with all the big names set to attend the show. Companies like AMD, NVIDIA, Intel, ASUS, MSI, GIGABYTE, Shuttle and Thermaltake among the bigger names confirmed so far, and given our past experiences there will be a few surprise products being held back in order to make a splash on the show floor.

We'll see a glimpse of these when the Taipei Computer Association, who runs the show in conjunction with TAITRA, announces its Best Choice Awards on the 29th of May. These awards are now in their 11th year, and offer an interesting overview of the range of products set to be shown off during Computex.

With Ivy Bridge due to hit just before Computex, it means that this year's show should have a lot more new products than last year, which suffered a little from falling well after Sandy Bridge, and well before Bulldozer and Sandy Bridge-E launched. This year we have also seen the next generation of GPUs being announced, whereas last year there was very little movement in graphics cards.

By Computex we should not only be seeing Ivy Bridge processors, but also a raft of innovations built around the accompanying platforms. Top of this list should be the long-awaited appearance of Thunderbolt on the PC, but also a broader spread of chipsets will be on show beyond the Z77 announced so far.

On top of this, expect to see a raft of new PC cases, power supplies, SSDs, Fans, Lights and all the other bits and pieces that make PC building such a fun experience. The big push might be towards Ultrabooks and Tablets, but at its heart Computex is still a show focused on the PC industry that we all know and love.

John Gillooly travelled to Taiwan as a guest of TAITRA.

FROM ATOMIC ONLINE

There's still a few days of the month to go, but today's the day we go to press with the next (mighty sexy, I might add) issue of the magazine. So, today, you get... Post of the Month!

As usual, our winner will walk away (well, once he or she gives me his address and phone deets, anyway) with a shiny new toy from Razer. Also, Twinny, we're still waiting for your phone number, slacker!

But enough recriminations and vague waffling – who's won?!

krispy89! With his thread on work place comms. Lotsa... cables... in that one :)
www.atomicmpc.com.au/POTM136_krispy89

And who comes up behind, er, so to speak?

seehund, with his inspiring cycling thread!
www.atomicmpc.com.au/POTM136_seehund

SquallStrife, with a little walk down CPU memory lane
www.atomicmpc.com.au/POTM136_SquallStrife

And huge props to **NukeJockey**, for updating our Gamer ID thread
www.atomicmpc.com.au/POTM136_NukeJockey

Thanks everyone, and happy posting!

POTM

WINS A RAZER ELECTRA!

MODIFICATION

With Ashton "Two mods are better than one" Mills.

Unofficial Skyrim Patch (USKP)

Game Skyrim
URL www.atomicmpc.com.au/136_Unofficial_Skyrim

Skyrim, being a Bethesda title, happens to be one of the most moddable engines in the world. And as the game de jour at the moment, it has more mods released each day than there are fans disappointed by Mass Effect 3's ending.

But perhaps one of the most important mods you could ever download – in fact, *everyone* playing Skyrim needs this – is the Unofficial Skyrim Patch.

While Bethesda's recent 1.5 patch fixed a handful of bugs, for which we're certainly grateful, the modding community has traditionally done what Bethesda hasn't and addressed everything from small aesthetic issues like floating rocks, through to fixing critical game-breaking quest bugs. By way of example, the Unofficial Oblivion Patch, whose last update was as recent as November 2011, fixes a staggering 4500 bugs in the game. *Four thousand five hundred*!

The first version of the USKP has just been released, some six months in the making, and fixes 350 bugs in Skyrim not currently addressed by Bethesda. These include quest fixes, mesh and texture corrections, gameplay mechanic fixes, NPC and creature fixes, worldspace corrections, item fixes and even a bunch of corrected typos in text (and speaking of, I recommend the 'English Strings' mod, to load after the UKSP to correct for Americanisms **www.atomicmpc.com.au/136_English_Strings)**.

The list will undoubtedly grow as more issues are discovered, and indeed the current release includes a few fixes from my very own Savegame DeBloatifier mod (the USKP integrates the Nirnroot Glow and Ash pile fixes).

For a list of fixes, see the full changelog at **www.atomicmpc.com.au/136_Unofficial_Skyrim_Changelog**.

Using the mod is as simple as loading it after Skyrim.esm (so that if any mods alter the same records as USKP, these take priority) and, while currently in Beta, it should be out by the time you read this (which means you can find it at Skyrim Nexus, in addition to the Dark Creations link above).

Firearms Rebalanced

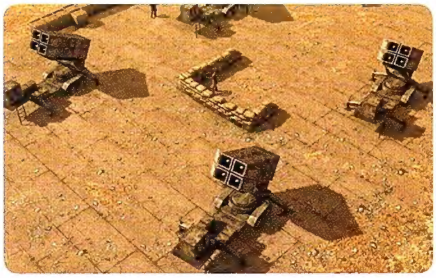
Game	Jagged Alliance: Back in Action
URL	www.atomicmpc.com.au/136_Firearms_Rebalanced

The re-invention of Jagged Alliance with JA:BIA brings with it a number of changes, not the least of which is that the game isn't very moddable. However, visions of new weapons, sounds, characters and more kept the gaming community hard at it anyway, and they started figuring out the packaging formats to shoehorn mods into the game. Pretty quickly there were a range of working mods, though not particularly pretty ones, and now the developers, Coreplay, have started adding features in recent patches to help make modding easier.

While currently the number of mods available can be counted on two hands, there are a few gems to be had. One of these is the Firearms Rebalanced mod, which aims (as you may be able to guess) to rebalance weapon stats realistically, but also adds other features like AI being able to engage at longer distances, snipers actually gaining an accuracy advantage for being prone, re-pricing of some weapons based on their accuracy or damage, and weapons across the board doing more damage. No longer will NPCs take twenty shots before they fall.

The mod is actually based on and integrates another great JA:BIA mod called Blue Dawn, which alters ammunition stats, increases charges on some items, adds a few new weapon images and tweaks the militia. Together, these mods create a more hardcore and faster gameplay experience, where cover is more important and weapons react the way you expect them to (based on your other virtual experiences of the weapons, of course).

JA:BIA certainly has its faults, but Firearms Rebalanced, and Blue Dawn upon which it is based, help to address some of the more gameplay oriented issues.



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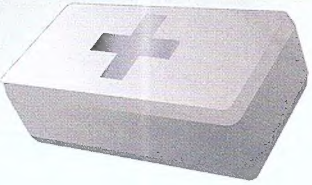


Anno 2070
- Patch v1.04

Combat Mission: Battle for Normandy
- Patch v1.10

The Sims 3
- Patch v1.33

Dragon Age 2
- Patch v1.04

GEARBOX

All the coolest gadgets & gear.

BenQ W7000 Home Cinema 3D projector

Price: $3799 **Website:** www.atomicmpc.com.au/136_BenQ_W7000

We recently went and had a visit with the folks at BenQ, and were really impressed at the efforts the company is going to turn their entire business Green over the next few years. However, as much as we'd like to, we're probably not so impressed that we're going to run out and drop nearly four grand on BenQ's shiny new 3D projector.

On a journalist's salary? Gah!

Still, it's a pretty nice piece of kit. With 2000 ANSI lumen brightness, a 50,000:1 contrast ratio (that's good, by the way), and lots of tricks to make your movies look great in all dimensions (okay, maybe not the fourth and above). Projecting in full 1080p, this is possibly the last word in home entertainment, assuming you have a nice handy blank wall.

Gee... it would go well with the AVR 265... hmm.

The Dark Ages, Decisive Battles of the Ancient World, King Arthur

Price: from $34.95 **Website:** www.historychannel.com

Time to get your history on, folks.

If you're a fan of, say, Civilization, or maybe Total War, you probably like a mix of history and combat in your gaming life. So how about you learn some of the real stuff? These three new documentaries from The History Channel are pretty self explanatory. The Dark Ages looks at post-Roman Europe, and will, hopefully, end on a nice Viking high note. King Arthur delves into the history of the famous mythical king, and likely features lots of shots of plate armour, which we must say is VERY WRONG. But we still want to watch it.

Finally, Decisive Battle of the Ancient World has got you covered for all your Greco-Roman action. Oil not included.

DECISIVE BATTLES OF THE ANCIENT WORLD
THE DARK AGES
The Fall of Civilization, The Rise of a New World Order
KING ARTHUR AND MEDIEVAL BRITAIN
HISTORY
PG
M

Hauppauge Broadway

Price: $329

Website: www.atomicmpc.com.au/136_Broadway

The modern house is a complex technological entity. The house of the modern computing enthusiast or technophile... whoa. Packed with stuff that can beam data, crunch numbers, predict the future... and that's just the toaster! However, there's one bit of tech that even we think might be worth adding to the mix: Hauppauge's new Broadway network TV tuner.

This neat little box lets you watch TV on your iOS or Android devices, and not just around the house, but anywhere there's a wireless connection – even overseas! Sure, it might be cool to watch the State of Origin on the toilet at home, but imagine being able to watch it in some really awkward place, like a London bus! Okay, we're reaching, but the Broadway is pretty neat. It just plugs into your home aerial and router, and then lets you beam away, or record to USB, and much more.

WD Thunderbolt Duo Storage System

Price: from $699

Website: www.atomicmpc.com.au/136_Thunderbolt_Duo

Ah, storage, the bane of modern existence (okay, possibly only a first world bane).

New music, new movies, reams of documents and photos, videos of friends creatively embarrassing themselves... it all tends to spiral out of control, so having a convenient and central space to store one's digital cruft is pretty damn important. Thankfully, Western Digital has got us serial content hoarders covered.

The new Thunderbolt Duo storage system features double-safe data protection, super-fast transfer rates, both 4 and 6TB models, RAID 0, 1 and JBOD options, HDDs that are user serviceable (well, replaceable, anyway), and even the ability to daisy-chain multiple units together for epic and expandable storage options.

Well, my por... I mean, my media collection just found a new home.

Harman Kardon AVR 265

Price: $1199

Website: www.atomicmpc.com.au/136_AVR_265

Here's one for the serious AV types out there, a giant, almost monolithic box of awesome from Harman Kardon that'll rock you in your socks.

The AVR 265, part of the 2012 line up from the popular AV brand, is a 7.1 capable audio-video receiver with five HDMI inputs and 95-watts of power per channel. It can support a second speaker zone, network connectivity for internet radio or playing back audio from network devices, is optimised for 3D and Blu-ray viewing, all the flavours of Dolby audio modes, and even features a special mic for an automated EQ setup procedure.

It's like the monolith from 2001, but for awesome music, not baffling extraterrestrial mysteries.

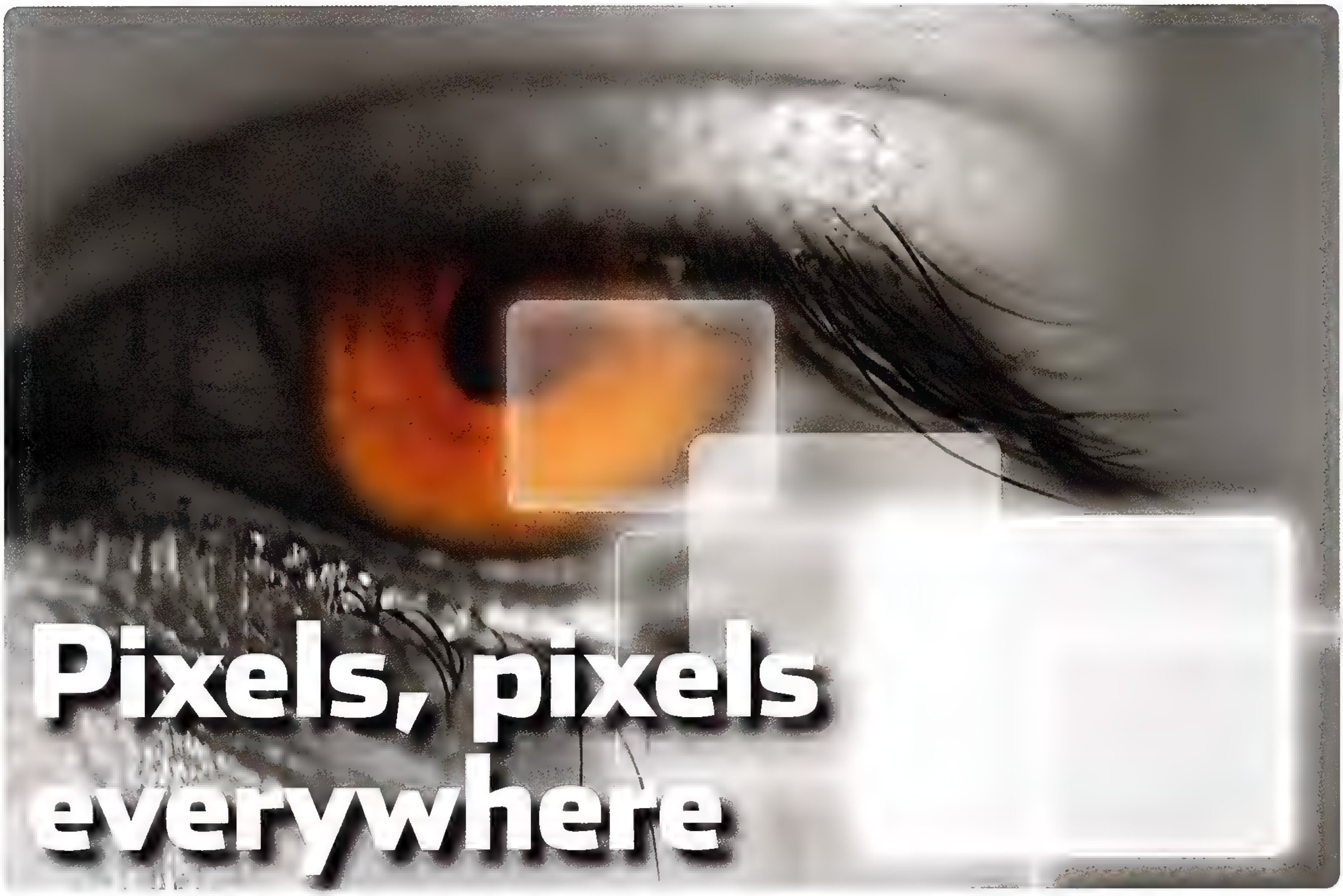
Logitech Ultimate Ears

Price: from $59.95 **Website:** www.atomicmpc.com.au/136_Ultimate_Ears

Logitech makes a huge dent in our Atomican's Choice Survey every year with its mice and keyboards, but the company knows a thing or two about sound, as well. From desktop units to headphones, many a gamer enjoys all manner of explosions, bleeps, and cussing via Logitech cans.

The two new Ultimate Ears headphones are actually in-ear models designed for smartphone and tablet users, though, being tuned as they are for pretty serious bass, they'd likely work for some lightweight gaming gear, too. Available in noise-isolating (we have no idea either) and noise-cancelling (that makes more sense) models, these earphones let you have a single set of phones no matter what you're doing on your phone or tablet.

Anyway, with on-cord controls and integrated mic, these are great for any serious mobile user.



Pixels, pixels everywhere

Jake Carroll thinks your pixels are about to multiply like rabbits.

The consumer electronics market is once again besotted with the apparent glory of Apple's new tablet. Branded simply as "The New iPad", its main claim to fame is an extremely high-resolution display panel. This month we're dissecting the new retina display and the high-definition era, trying to make sense of situations that a resolution of such density and proportionality makes sense, or whether it is superfluous.

Once again, technology is being called 'magical.' Magic it may not be, but a slight innovation it is. The display on board the new iPad sits at a resolution of 2048x1536 pixels, or 3.145 megapixels. The pixel density sits at around 103.90 pixels per centimetre.

There was much conjecture in the media as to exactly which fabrication technique would be used to produce such a high-resolution display. To date, there had not been a display of this proportionality with such a high pixel density. Many industry analysts predicted the use of an IGZO-based technology (Indium Gallium Zinc Oxide) to allow such a high density, but it appears that (in the current production run of the new device at least) this has not been the case, and a display technology produced by Samsung Semiconductor is being employed instead. This isn't to say that the IGZO technology produced by both Sharp and LG mightn't follow at a later point in time once increased production takes place.

IGZO

Indium Gallium Zinc Oxide, as the very descriptive name implies, is a semiconducting composite material that can be used as a channel for a transparent thin film transistor (TFT) or the generic components that make up a normal LCD panel. It is almost guaranteed to be the same kind of TFT you might be reading this on (assuming you read the electronic version at **www.atomicmpc.com.au/Atomic_Digital_Edition**). The IGZO fabrication technique yields roughly forty times the electron mobility of generic amorphous silicon TFT technology. This in turn allows much smaller pixels, and thus a greater pixel density allowing for resolutions significantly higher than HDTV (4K and 8K resolutions), or it provides far lower latency in reaction times of pixel on-off states for high-frequency displays.

The RED Scarlet, with Mysterium base CMOS. One of the high end 4K resolution cameras currently being used to film 'The Hobbit' and many other upcoming motion pictures.

> The technology 'cheats electron death' using different layers to create a barrier, preventing capacitive coupling of conductive lines.

The only known company (currently) able to fabricate and produce the IGZO panel en-masse is Jusung Engineering, of Korea.

Super High Aperture

The other technology allowing extremely high pixel density to the mass market is Super High Aperture or SHA. Invented by Sharp and implemented by Samsung for the new iPad, the technology 'cheats electron death' by using different layers to create a barrier, preventing capacitive coupling of conductive lines on the display. Capacitive coupling leads to image degradation and a less defined image quality.

From a technical standpoint, the SHA technique is the poor cousin of the IGZO method of panel fabrication and lacks the extremely low latency response time capabilities of the IGZO semiconductor sandwich.

Given the new iPad is using SHA to begin with, one could conjecture that there will be differences between the quality of display and panels between production runs of the initial iPad and the later generations of the production life cycle. Just how different the actual panel will look to an end user who doesn't have a colorimeter strapped to the front of the iPad, however, is another thing.

Resolutionary?

Now we know a little more about the technology behind the panel fabrication. It's significant that we can have this much screen real estate in a tablet, much less any display. The largest consumer-grade display panels for generic computing/workstation use top out at 2560 pixels horizontal. We're now nearing these resolutions in something far smaller. In theory, this means we could scale a panel the size of Apple's 'retina' to a 30 inch consumer panel and have well over 5000 pixels horizontally. At this point we reach an impasse concerning the current technology we have and our determination to hold onto it, versus the drive to push things ever further.

Contrary to popular belief, the 1080p our LCD and Plasma panels are capable of is actually a dumbed-down version of what the filmmakers intended for us in the long term. More and more films are being shot in what is known as 4K resolution. Digital cinema standards currently sit at 4096x3112 for a 'full aperture' 4K image aspect ratio. The next time you go to the cinema and you're made aware that film you are watching/cinema you are in is 'full digital', there is a good chance the digital LCD projector you are watching the movie through is projecting the image at 4096x3112 pixels. Barco, Sony and several others will happily furnish you a 4K projector for your viewing pleasure. For the price of an average family home, that is.

Content? What content?

Blu-Ray at 1080p is currently as good as it gets for consumer-grade entertainment at home. There are plenty of experimental films that have been uploaded to the Internet in true 4K resolutions, but if you don't have a panel or display to take advantage of it, what's the point?

That leads us down the path to questioning the relevance of an ultra high definition display device that is 22 centimetres wide with a strange aspect ratio. Does the new iPad actually make sense in terms of the kind of content we view? More than this, if the content does become available and we find enough beyond-1080p content to stream over YouTube, what can the human eye actually perceive?

It's widely accepted that the human eye can perceive about 10 million different colours, or permutations of light mixing together, to create distinct reflective differences. Unfortunately, the marketing material that suggests Apple's 'retina' display is named as such because of its visual similarity to the detail a human eye's retina perceives is slightly inaccurate if we look at the science behind how the eye actually works.

Visual Acuity

The truth is, the only way we can actually measure the clarity, detail and quality of a resolution is to understand visual acuity. That is,

Overcoat Process	Normal	UHA/SHA
Structure		
Apparent Advantage	Easy process and fabrication, not too expensive	Extremely high aperture ratio
application	Conventional TFT, HDTV's, Mobile phones	High brightness, High resolution, transflective/reflective modes

Standard display technology using current generation TFT fabrication techniques, compared to SHA fabrication techniques.

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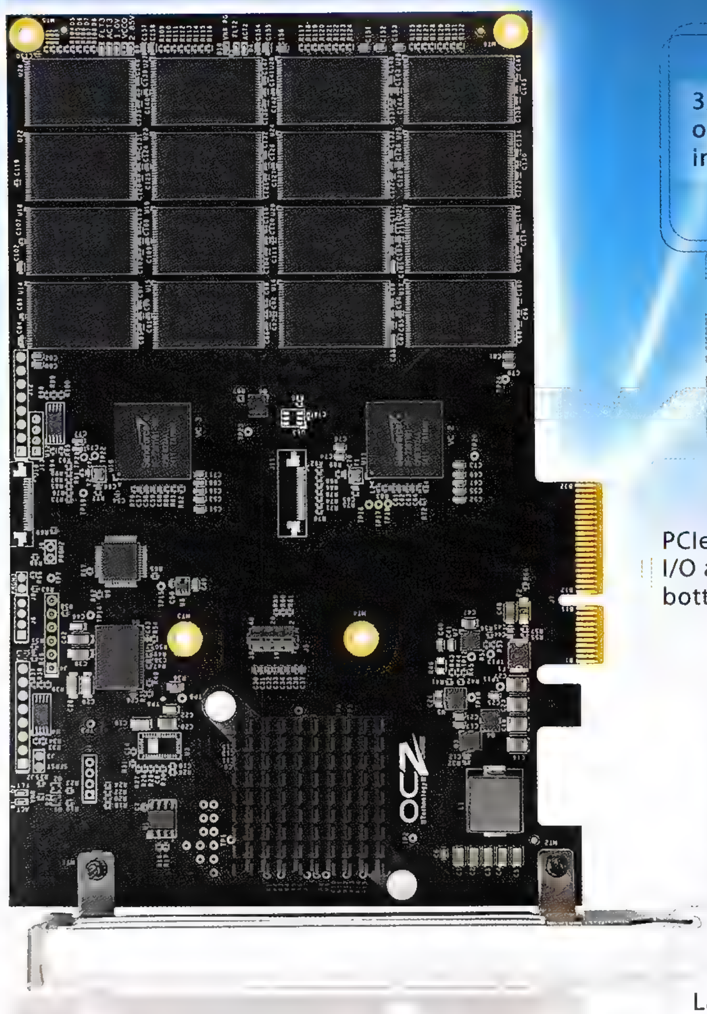

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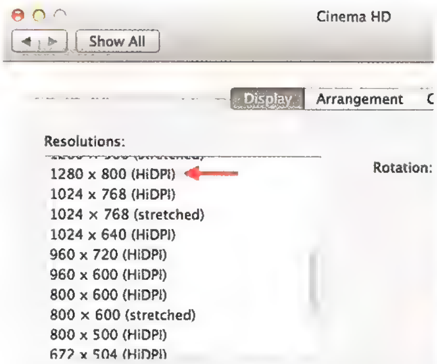


Cinema HD

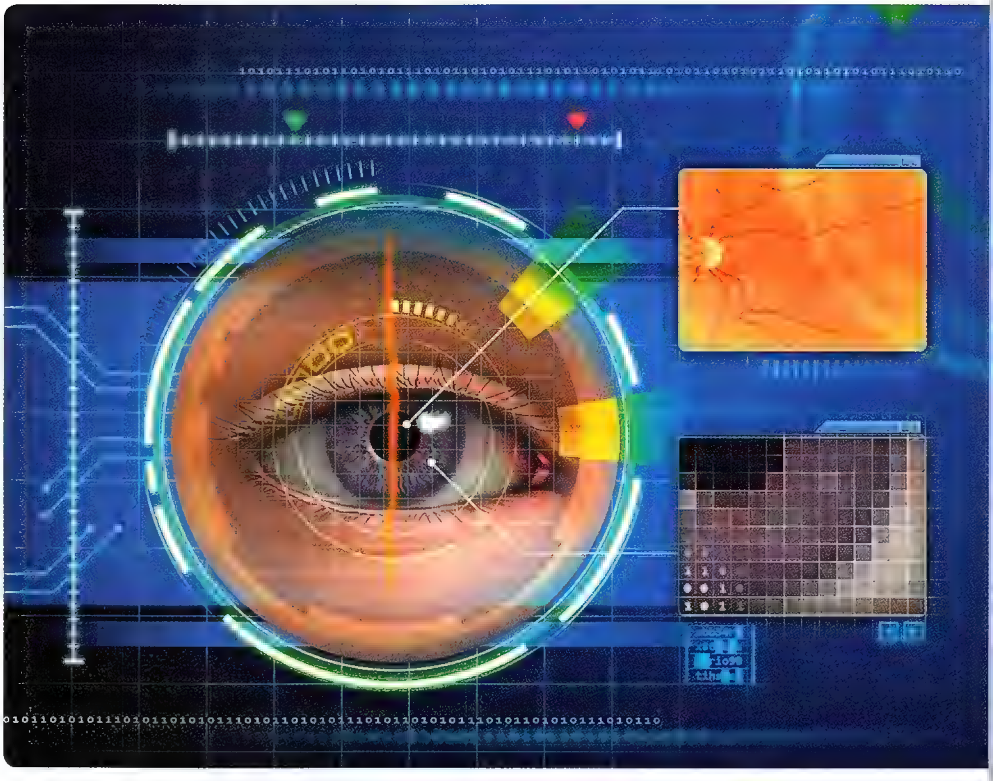
Resolutions:
1280 x 800 (HiDPI)
1024 x 768 (HiDPI)
1024 x 768 (stretched)
1024 x 640 (HiDPI)
960 x 720 (HiDPI)
960 x 600 (HiDPI)
800 x 600 (HiDPI)
800 x 600 (stretched)
800 x 500 (HiDPI)
672 x 504 (HiDPI)

Rotation:

Apple have laid the ground work for ultra high-definition monitors by introducing HiDPI resolution scaling into Mac OS X Lion (albeit hidden).

clearness of vision, which is dependent upon the sharpness of the retinal focus within the eye, and the sensitivity of the interpretive function/facility of the brain. Another way of putting it is that visual acuity is a measure of the spatial resolution of our visual processing system. Already, it's a bit difficult to simply say the 'retina display' has the same visual detail in resolution as the human eye, as the very concept of resolution isn't as simple as first thought. It's not just about the number of horizontal pixels by the number of vertical pixels According to quotes from the late Steve Jobs, of Apple Inc, there was allegedly a fairly well understood and accepted 'magic' number of pixels per square centimetre or dots per square inch (300) that the human eye can resolve, with any more being futile, or unnoticeable in improvement to the human eye at certain distances. This is a subjective measurement. It's our experience that the factors behind resolving pixels on a screen are determined by viewing distance from screen, brightness, the individual viewing the display, and a host of other factors.

Irrespective of these technical foibles, Jobs' comment is challenged by industry, such as Raymond Soniera of DisplayMate Technologies Inc, who suggested that the resolving capability of the human eye is actually closer to 477 pixels per inch at 305mm from the display device, or 36 arc-seconds per pixel (**www.atomicmpc.com.au/XRay_EyeRes**).

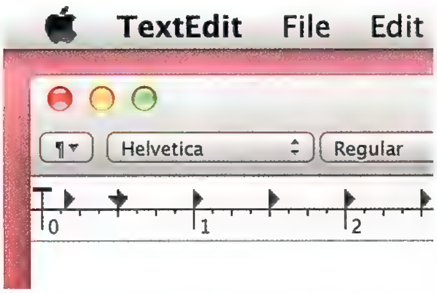


To suggest the iPad retina display is useful in its current state for viewing high-resolution photos (given the device has a 5MP camera) is probably appropriate if zooming in on images very close, to look for specific details. For video or moving content, it might not yet be as appropriate.

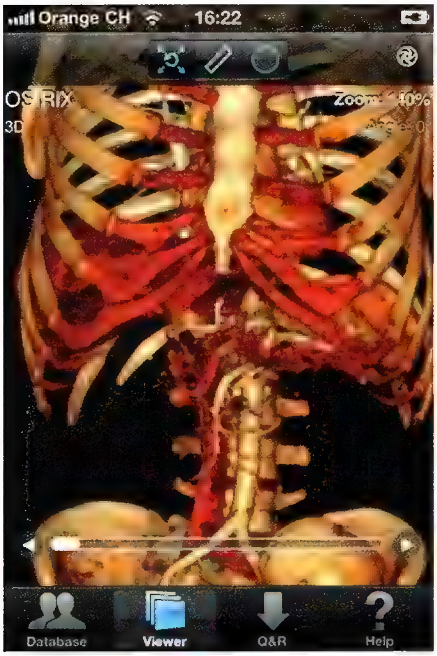
A sign of things to come

It's suggested that next generation laptops and 'ultrabooks' will contain ultra high-resolution displays. The implications of this are that applications will need to support such high-resolution displays. Current generation operating systems scale natively to 1080p resolutions with icons, window frames and window managers all being aware of the relative size and usability of human user interfaces on our current generation panels. If we change these panels to something with greater than 2000 pixels horizontally and aim to keep this compressed into a 13" or 15" form factor, with the icons remaining the same size in terms of pixel count, we'll barely be able to perceive our icons on a screen.

Tablet devices have long been promoted as an 'enabling' technology. Evidence of this is seen in all the marketing materials that the tablet vendors generate. It's an educational tool for children, who can use it to read and interact with E-books. It's a lecturing and presenting tool, for those trying to get their point across, and it's a visualisation device for research scientists, trying to unlock the most arcane secrets of some



When turned on, HiDPI changes the size of all text, icons and windows to accommodate a screen with a much higher pixel density. Consequently, on current generation panels, everything is enormous.



The Osirix DICOM medical imaging viewer shown here on an iPhone, allowing diagnosticians and clinicians to browse a 3D scan and reconstruction of a human being.

heretofore unexplored human biological function.

When we look at where industry is (whether it be scientific research, mining, engineering or health care), the high-resolution display proposition suddenly starts to make much more sense. There are several companies around the world that specialise in ultra high definition display panels for diagnostics work in health care and for scientific discovery. Companies such as EIZO produce full colour panels that are capable of 4096x2160 pixels with a 10bit colour channel on a DisplayPort link.

Taking things a step further, it's easy to conceptualise that we can do this on our tablets too. For a medical imaging specialist to be able to view images on a portable screen or tablet in a remote location, or for that matter, have images sent across to be viewed on site, potentially saving the lives of those without equal access to healthcare, is a genuine enabling technology in action. Never mind the fact that such an area probably has such poor communications services that getting data-rich diagnostic images to the tablet to begin with is going to be a significant challenge.

Hard limits

Remember when we had that crest in GPU power and our games just could not run at 60fps in the highest resolution we could crank our CRTs? We have fond memories of trying to play Quake 3: Arena in 1600x1200, but had some woeful frame rates bursting out of our poor little TNT2 and then slightly later on, our MX440. One might well say, those days are gone. We've got plenty of GPU grunt to haul around the heaviest graphics engines in 2560x1600 these days on our 27" LED panels and we don't suffer for it – but what about the mobile market?

The new iPad, in a similar vein to the NVIDIA Tegra 3, has a multi-core GPU on its SoC (System on a chip). While we haven't seen complete benchmarks for either the Apple A5X nor the NVIDIA Tegra 3 in a side-by-side metric, we remain cautious and critical concerning the performance claims. The ability to render a 3D image on a 3.1 megapixel display at 60 frames per second with a mobile platform GPU remains to be seen.

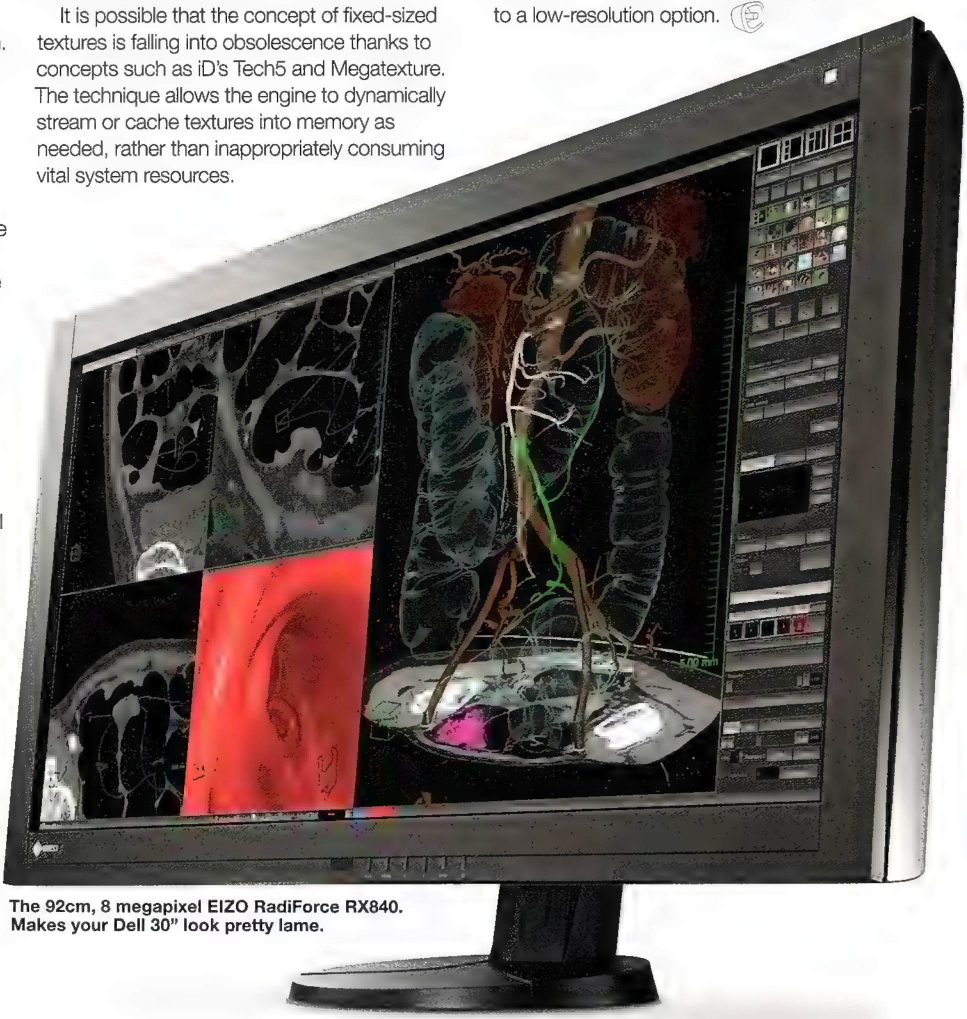
We started to wonder how the devices of tomorrow will deal with legacy content in full screen mode. If previous generations of a platform were only designed to run textures or polygonal models in 1024x768, what happens to image quality when you effectively double the resolution without doubling the polygon count, rendered pixel size or texture maps size?

It is possible that the concept of fixed-sized textures is falling into obsolescence thanks to concepts such as iD's Tech5 and Megatexture. The technique allows the engine to dynamically stream or cache textures into memory as needed, rather than inappropriately consuming vital system resources.

What happens to image quality when you double the resolution without doubling the polygon count, pixels or texture maps?

We're all going to go blind

We've got increasing pixel real estate on devices that seem to be shrinking, becoming ever slimmer and smaller screened. What we lack is the content to make sense of these amazing resolution propositions. The benefits of such a high-resolution future may be unfounded, but we can't make that judgment yet. At worst, we'll have a really dense screen (pixel wise) with very little media to take advantage of it, and a graphics hardware subsystem struggling to keep up with the demands of such a power hungry display. At best, we'll get a finely detailed experience that we can all enjoy, and we won't be subjected to the harsh edges that lower resolution displays often bring. Interestingly, very few users currently complain about their tablet screen resolution, but if human nature is anything to go by, the instant an ultra high-resolution tablet is viewed, we will only grudgingly return to a low-resolution option.



The 92cm, 8 megapixel EIZO RadiForce RX840. Makes your Dell 30" look pretty lame.

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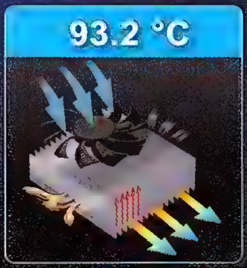
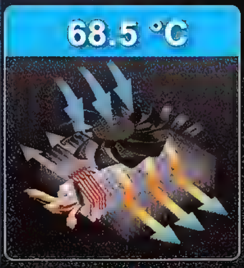
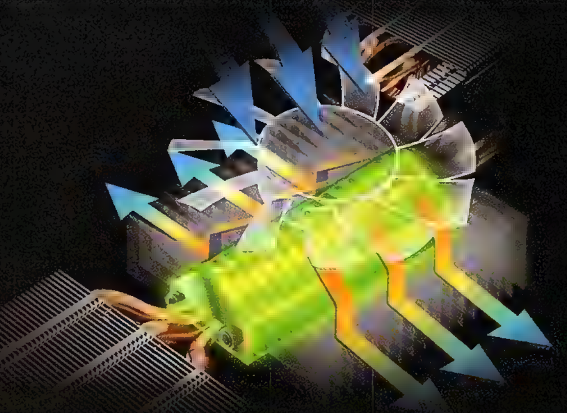


without "Triangle cool"



with "Triangle cool"



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*With an ambient temperature of approximately 24°, all testing ran under FurMark.

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INPUTOUTPUT

Dan Rutter brings the answers to your questions like no-one else can.

I/O OF THE MONTH

Death By Monitor, Part One

I My 22-inch LCD's backlight died (could still use the monitor if I shone a torch on it!), and I downloaded the service manual and bought a new, or at least working, backlight assembly on eBay and am reasonably handy and ready to install it. But I'm worried about getting zapped.

I know CRT monitors had big scary voltages inside and LCDs are supposed to be much better, but these cold-cathode fluorescent tube backlights run from high voltage too. I remember you talking about working on live gear with one hand behind your back; should I do that here, or just hand the job to someone who knows what the hell they're doing?

Noah Gratwick

O The guts of a CRT are, as mentioned above, dangerous. Lots of volts, lots of current capacity, and if a CRT lacks a "bleeder resistor" to drain away the charge on the tube, it can give you a serious shock even when it's been turned off for some time.

The guts of an LCD screen are, in comparison, almost safe.

The "almost" is in that sentence for two important reasons.

One, if your monitor has a built-in power supply – in other words, the monitor plugs straight into the wall – then it's possible to electrocute yourself by monkeying with the PSU when the monitor is still plugged in. If it's not plugged in there may be capacitors still holding a bit of charge, but that's not very likely. The power supply should also have its own sub-enclosure, to keep inquisitive fingers out.

Two, you can kill yourself with almost any electricity source if you're dedicated enough. Whack a couple of small nails into your chest on either side of your heart and hook them up to a nine-volt battery, and there is a significant chance that you will die. In the history of the world, at least one person has managed to kill himself with the few volts from a *multimeter* in resistance mode; though he had to stab the probes into himself to do it.

Presuming you're not in the mood do something like that, replacing a cold-cathode fluorescent (CCFL) backlight may be annoyingly fiddly, but it isn't very dangerous. The two basic components of the backlight system are the CCFL tube, and its own little inverter power supply. (I hope you bought the right parts to replace what's actually broken; there's no point replacing the tube if it's the power supply that died.)

CCFL power supplies of this sort turn low-voltage DC input into several hundred volts of AC, at a frequency of tens of kilohertz. They can manage hundreds of milliamps, too, so they're not one of those high-voltage, ultra-low-current devices like small air ionisers, which are quite safe. It wouldn't be very hard at all to kill yourself with a CCFL inverter.

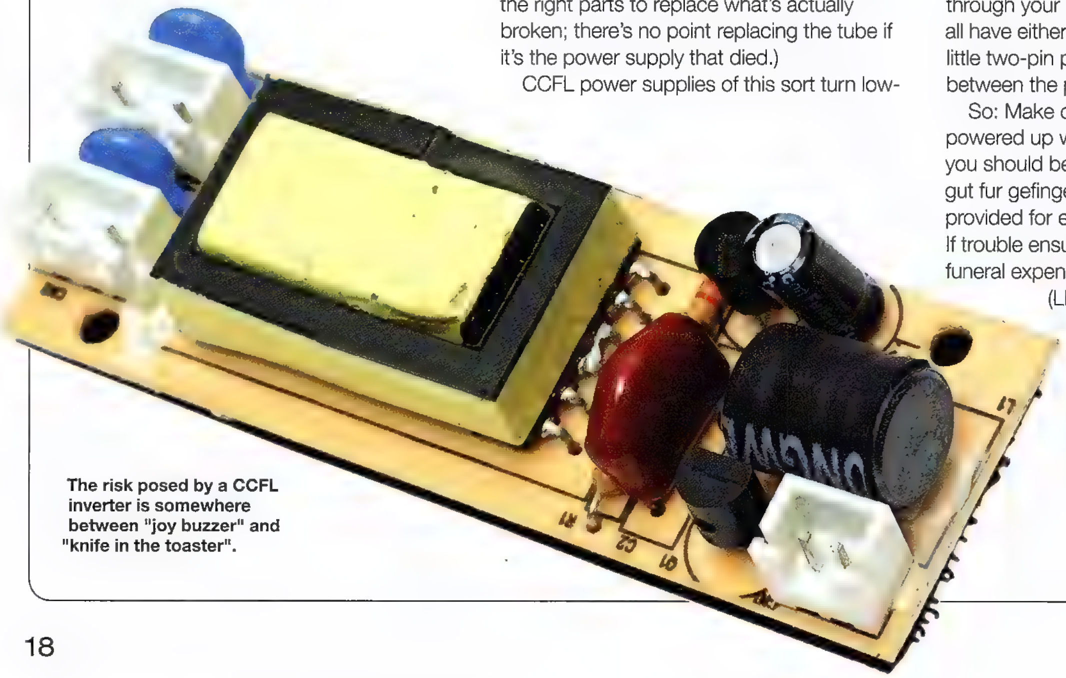
I/O OTM

WINS A THERMALTAKE CHALLENGER PRO KEYBOARD

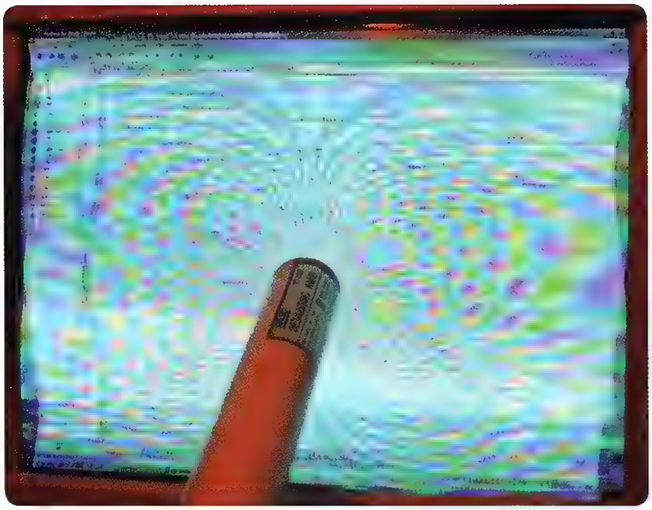
And yet this task remains pretty safe. If you work on the monitor when it's not plugged in, the inverter won't do anything; it doesn't hold a charge. And even with the inverter energised, unless you start cutting and stripping the output wires and holding them in your hands, there's no way for the current to flow somewhere dangerous, like through your heart. The monitors I've seen all have either hard-wired connections, or little two-pin plugs with a few millimetres between the pins.

So: Make damn sure the monitor is not powered up while you're working on it, and you should be fine. Inverter outputs are nicht gut fur gefingerpoken. This letter-answer is provided for entertainment purposes only. If trouble ensues, do not sue me for your funeral expenses.

(LED backlights, by the way, run from only a few volts DC.)



The risk posed by a CCFL inverter is somewhere between "joy buzzer" and "knife in the toaster".



The only thing I miss from the CRT days is the degaussing light-show.

Death By Monitor, Part Two

I I've been having a discussion online with a fellow who believes that the electromagnetic field from a CRT monitor is capable of frying electronic components.

I thought this was a bit silly so I pulled out an old CRT and a couple of old CPUs, left one CPU on the top of the monitor at the rear, and one directly in front at the base. I left them there for 2 days with the monitor running on a screen saver. When I tested the CPUs they were still working perfectly.

Of course this fellow decided I must be lying and then claimed that the US government was developing an EMP weapon that can disable electronics, as some sort of proof of his earlier claims about CRTs.

Now I'm not an expert but I thought that the type of EMP that disables electronics was often seen when nuclear weapons are detonated. I would have thought that the electromagnetic radiation from a CRT monitor was not quite on the same scale.

Chris Byrne

O Presuming the person you're talking to isn't a complete black-helicopters foil-hat HAARP-Tesla-and-Zeta-Reticulans kind of guy, he could perhaps have reached his conclusions via the fact that it definitely IS possible for a CRT to damage two kinds of computer-related devices.

One device, like floppy disks, low-coercivity magnetic media and the cheaper kinds of audio cassettes and credit-card magstripes, can be wiped by the magnetic field of a CRT's degaussing coil (the thing that makes a sort of "bong" noise and makes the image all wobbly). Even this is a bit marginal – you've got to put the floppy right up against the monitor casing, and the distance between the casing and the coil is important – but it's possible.

Secondly, CRTs naturally accumulate an electrostatic charge on the outside of the tube, because of all the electrons being shot around inside it. Even sparks too small to see or hear can damage electrostatic-discharge-sensitive electronics. Press a video card or memory module up against a good crackly olden-day CRT, and you could completely wreck the thing instantly.

That's about it for the dangers to other components posed by a CRT, though. Open one up and the high-voltage supply to the tube can zap all sorts of things, including you. And the electron beam hitting the tube can also cause a small amount of X-ray radiation, which can in theory damage certain electronics, but is almost all absorbed by the tube's leaded glass. But this is really clutching at straws. In general, the only way a CRT will kill other devices is if you drop it on them.

Your correspondent seems to be in a similar muddle regarding anti-electronics weapons. You *can* create an electromagnetic pulse (EMP) by means other than a nuclear explosion, but you need either a lot of high-powered broadcast gear and a big antenna array, or a device wonderfully titled an "explosively-pumped flux compression generator."

I think your correspondent may have confused this with High-Energy Radio Frequency (HERF) weapons, which are just high-powered directional radio transmitters, doing basically the same thing as an EMP but on a much smaller scale. A HERF gun based around a microwave magnetron can crash computers at a distance and kill computers at close range, but I do not encourage you to make one, on account of how they're only mildly safer for the user than the Ghostbusters' Proton Packs.

Codger gaming

I I'm incredibly old by gamer standards (59, you whippersnappers!), and my right, mousing, hand is getting pretty arthritic. I've tried several gaming mice, but I really can't do anything more than left button and right button any more, and that's not enough. I'm OK on the keyboard with my left hand, but I need at least a couple more "mouse" buttons that I can work elsewhere, like maybe with my feet.

I haven't got far by asking my physio about this. There are input devices in his Assistive Technology catalogue, but most of them are useless to me, and apparently putting the magic words "Assistive Technology" on something allows you to sell it for 50 times the price.

I could maybe buy some cheap pedal switches, rip apart a USB keyboard and wire the switches in place of some keys. One for each foot, maybe one on the side of my desk drawers that I can hit with my right knee; that'd do. It's a hassle, though. My fine soldering's gone the same way as my mouse-buttoning.

Is there a retail product that does this, and doesn't cost $1000?

Milovan M.

O I'm happy to say that, yes, you can get a questionably-well-built but functional single USB pedal switch for about $10 delivered. There's also a three-pedal version for less than $25 delivered. They all seem to be made by PCSensor (pcsensor.com), and they're all over eBay and other online cheapie-dealers; just search for "usb pedal."

By default, the single pedal (the only one I've played with) appears to the computer as a keyboard that can only ever say "b". If you've only got one pedal and you only want one simple keystroke, you can just bind something in your games to "b" and you're done.

The pedals come with software, though, that lets you assign other keystrokes with modifier keys, left or right mouse clicks, or a macro string of up to 38 keystrokes. So you can, for instance, make a pedal-press sign your name, save a document or close a program.

I'm pretty sure you can use more than one pedal simultaneously, too, because the configuration is stored in the pedal, not the software. Plug in one pedal at a time and use the software to set each of them up, then quit the software and plug all of your programmed pedals in. This also lets you take the pedals to another computer and use them right away. Mine worked on a Mac, too.

To continue my well-known commitment to good workplace behaviour, I feel duty-bound to mention that yes, you can bind Alt-F4 or Windows-D or Control-Alt-Delete to this switch, and with minimal modification cause it to be pressed when a coworker sits down, or leans back, or picks up the telephone...

Two required for bicycle simulators.

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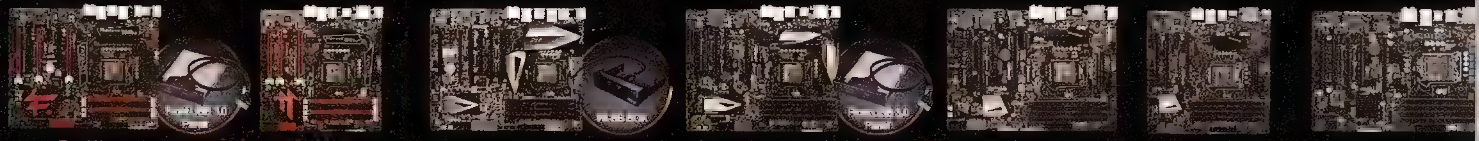

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6 SATA3	4 SATA3	6 SATA3	4 SATA3	4 SATA3	4 SATA3	4 SATA3
8 USB 3.0 (2 Front, 6 Back)	6 USB 3.0 (2 Front, 4 Back)	12 USB 3.0 (4 Front, 8 Back)	6 USB 3.0 (2 Front, 4 Back)	6 USB 3.0 (2 Front, 4 Back)	4 USB 3.0 (2 Front, 2 Back)	4 USB 3.0 (2 Front, 2 Back)
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2 PCIe 3.0 x16	2 PCIe 3.0 x16	5 PCIe 3.0 x16	2 PCIe 3.0 x16	2 PCIe 3.0 x16	2 PCIe 3.0 x16	1 PCIe 3.0 x16
Quad SLI, 3-Way CrossFireX	Quad SLI, 3-Way CrossFireX	4-Way SLI, 4-Way CrossFireX	Quad SLI, 3-Way CrossFireX	Quad SLI, Quad CrossFireX	Quad SLI, 3-Way CrossFireX	Quad CrossFireX

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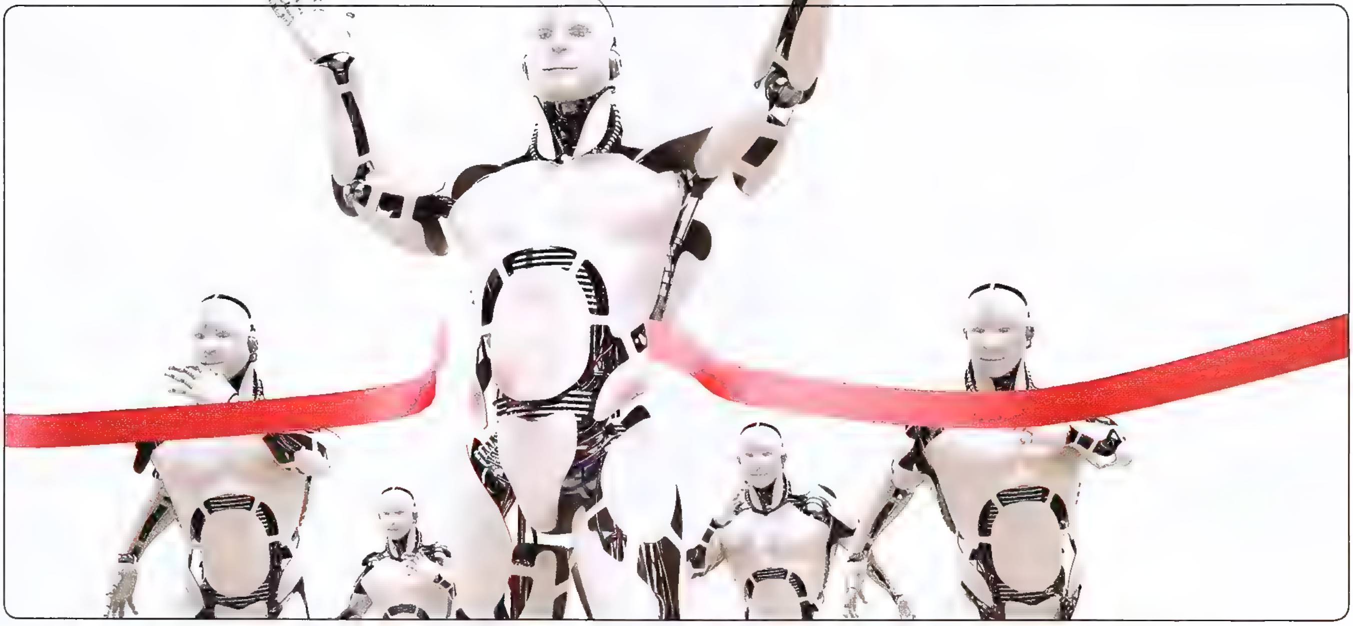

The cheating machine

Ashton Mills knows the game is afoot.

One of the things I've always found fascinating about artificial intelligence in games is that, for you as the player to enjoy yourself, the computer opponent must be good enough to challenge you, but not good enough to beat you. At least, not all the time.

In the gaming industry this is known as programming the AI to **lose convincingly**. You're the human, of **course** you're better than the puny computer, and you have to be able to win, otherwise you don't have fun and that defeats the purpose of playing a game.

Which puts all those players who think they have mad gaming skillz into perspective: you're not really as good as you think you are. You've had the wool pulled over your eyes. But what's most important, is that you actually enjoyed it. Perhaps until now, when I shattered the illusion.

Programming AI can be incredibly hard depending on the type of game. After all, often the computer player is being programmed to seemingly think and act like a human. Your PC's CPU may have a bazillion transistors, but it ain't no grey-matter processing machine that's evolved through millions of years. Much though we might like to think otherwise, even with the very best in AI advances our humble CPUs are still little more than programmable rocks.

Which is why an easy trick with game AI programming is to simply cheat. Most 'difficulty' settings in a game either change the degree to which your units deal and receive damage, or the AI is given resources and abilities the player doesn't have in order to 'balance the difference'.

Having the AI cheating is fine; it's a good solution to provide the mirage of losing convincingly, just as long as it's not **apparent** the AI is cheating. That's when players not only feel powerless at their inability to beat the game, but cheated too because – well – they **have** been cheated.

But it's not just the happiness of the gamer that's at stake: for better or for worse, the quality of a game's AI is intrinsically tied to its success. If the game is too hard you get frustrated and put it down. If it's too easy you get bored, and put the game down too. Either outcome is bad for the product and the brand, capable of impacting current sales through word of mouth and future sales with addons like DLCs.

And considering the market for a game can vary from casual players to hardcore gamers, this basically makes it impossible to keep everyone happy. Somewhere in there is an argument for game developers to split their titles into two target market segments, where the gameplay is intentionally different (or develop difficulty settings that are more than basic tweaks). For some reason, this terrifies most publishers. A product must always be the same, even across different platforms (a personal bugbear of mine – please explain why a PC port of a console game must retain the console interface? Lookin' at you Bethesda).

Some publishers have clued into this, or at least one has: CDProjektRED. The Witcher 2 is many things, most of them amazingly good, but one complaint about the game was that it was too easy. No amount of internal testing is going to match hundreds of thousands of real-world gamers, so inevitably what CDPR thought was a well balanced game turned out to be not that challenging, even on the hardest level. So they listened, and in the 2.0 patch added a new difficulty level – Dark Mode.

I haven't actually played on that mode yet. It freakin' scares me. Which is **awesome**. When's the last time you felt attached to the outcome of a game you were playing due its difficulty?

So next time you lose to the AI in a game, don't shout expletives at your PC or console and throw last night's pizza around the room. The game cheated, and it has to in order to compete with a human. But give it another go, and it might give you that rewarding sense of accomplishment when you win. Even if the game threw the odds in your favour and lost convincingly, just to make you happy.

Ashton is an AI subroutine from the future.
amills@atomicmpc.com.au

Motherb
By Design

Justin Robinson thinks there's a lot you don't know about the humble motherboard.

Motherboards come in a variety of shapes and colours, and for many, they're the first item picked when choosing to build a new computer. They play an essential role in the functioning of the entire system; working as the connection between each individual component, and providing a stable base on which can be placed a myriad of features.

Although many enthusiasts are more than aware of what makes a good choice when it comes to buying a motherboard, a surprising number aren't up to scratch on the processes involved in actually creating the motherboards that we use daily. For most, this knowledge has little impact on day-to-day usage – but to be a true Atomican, you have to go deeper.

What are they made of? How are they designed? How do you put it all together, and how do you minimise the amount of dead-on-arrival boards?

Lucky that we've assembled everything that a true enthusiast should know about every motherboard manufactured today.

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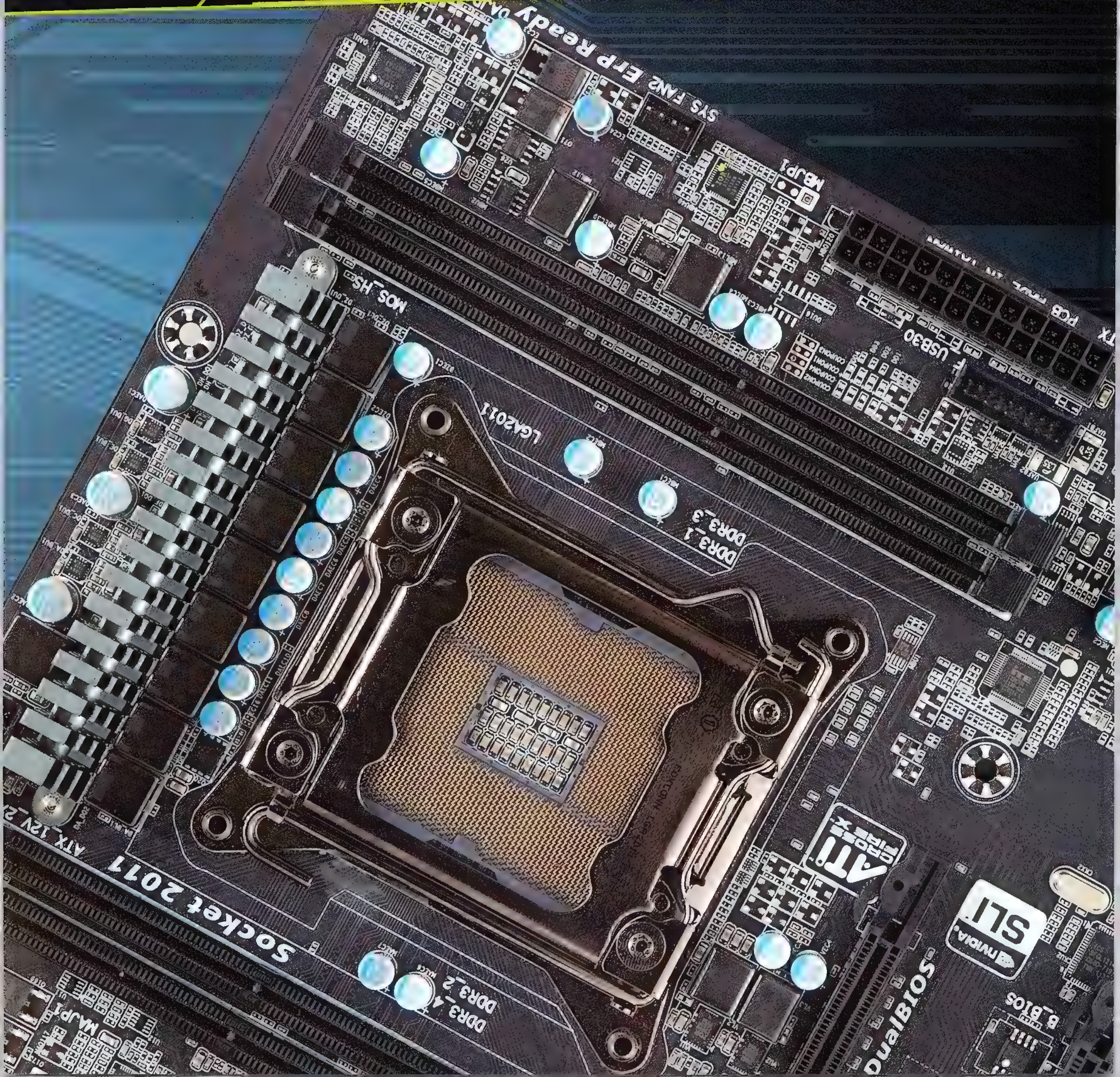
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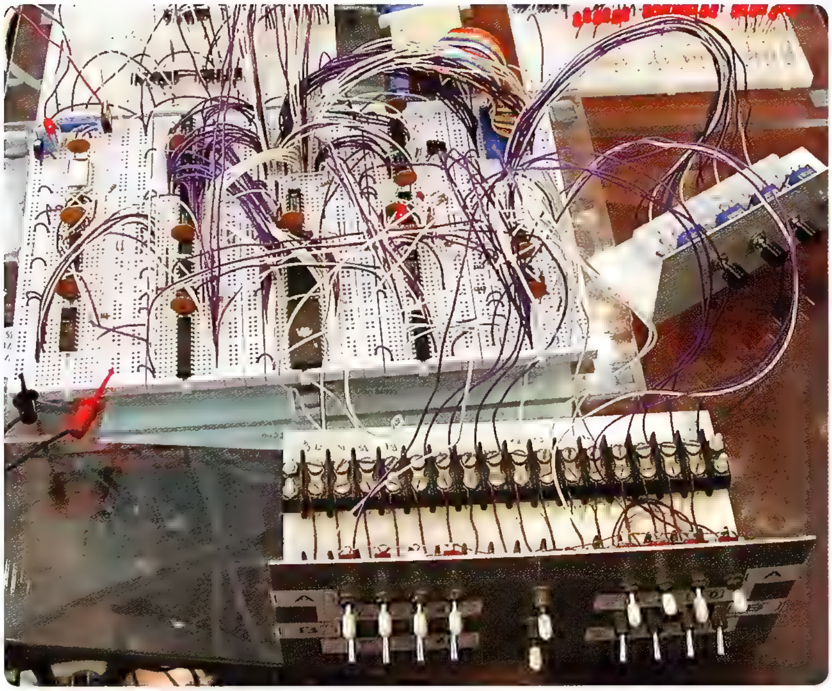
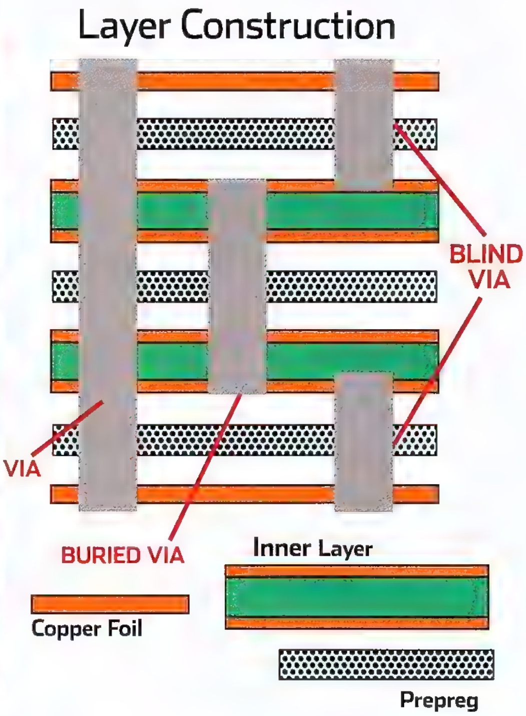
DDR3_3
DDR3_1
ATX_12V_2X
Socket 2011
DDR3_2
DDR3_4
ATI CrossFireX
SLI
DualBIOS
B_BIOS





Schemers and Schematics

In the early days of computing, devices had few functions. Programmed by paper punch-cards, these early computers could get by with simple wires that were plugged by hand into backplanes much like a telephone exchange, connecting the small amount of components together. As the industry progressed and the components became more complex, these bulky wires became haphazard, and took up so much room that manufacturers were having trouble making them any smaller. By this stage in early 1970, computers were fast enough to be used as mainframes and personal computers – they were about to explode in popularity for both business and home users. Clearly the wires had a number of problems.

To solve those problems, the **Printed Circuit Board** (PCB) was used. First invented in 1936 by Paul Eisler, an Austrian inventor who was searching for a more efficient way of manufacturing equipment used in World War 1 such as radar and radios, the PCB soon became his legacy. Quite literally modelled on the paper printing industry of the time, as described in his autobiography *My life with the printed circuit*, Eisler set about "putting to use the resources and established practice of [the printing] industry… to satisfy the need for an almost unlimited supply of fast changing electronic components."

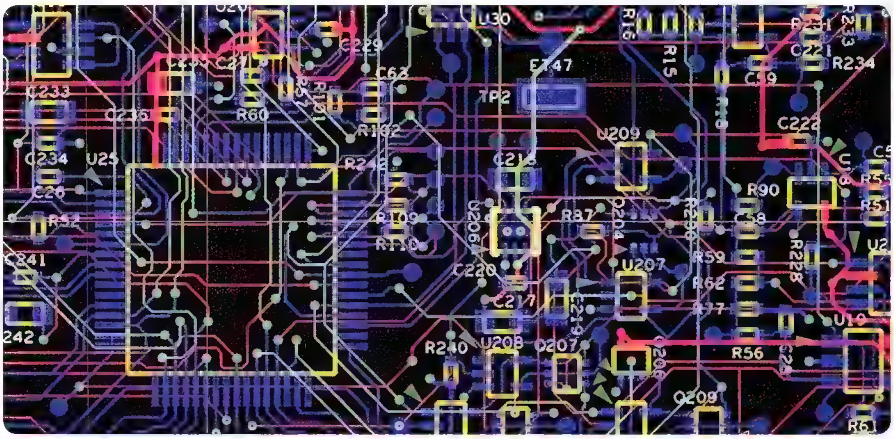
These early PCBs were rudimentary but perfectly functional analogues of today's motherboard; instead of using wires to connect components together, they were hard boards with small holes joined by copper lines called **traces**. Only one side of the board contained components, which were connected to the holes – and therefore the traces – by being soldered into place. This was a much more efficient use of space compared to soldering components together with wires, and sped up the manufacturing process remarkably. After seeing use in World War 2, they quickly invaded a vast array of consumer, business and military devices – mainframe computers now had a sturdy and reliable method of inter-component communication.

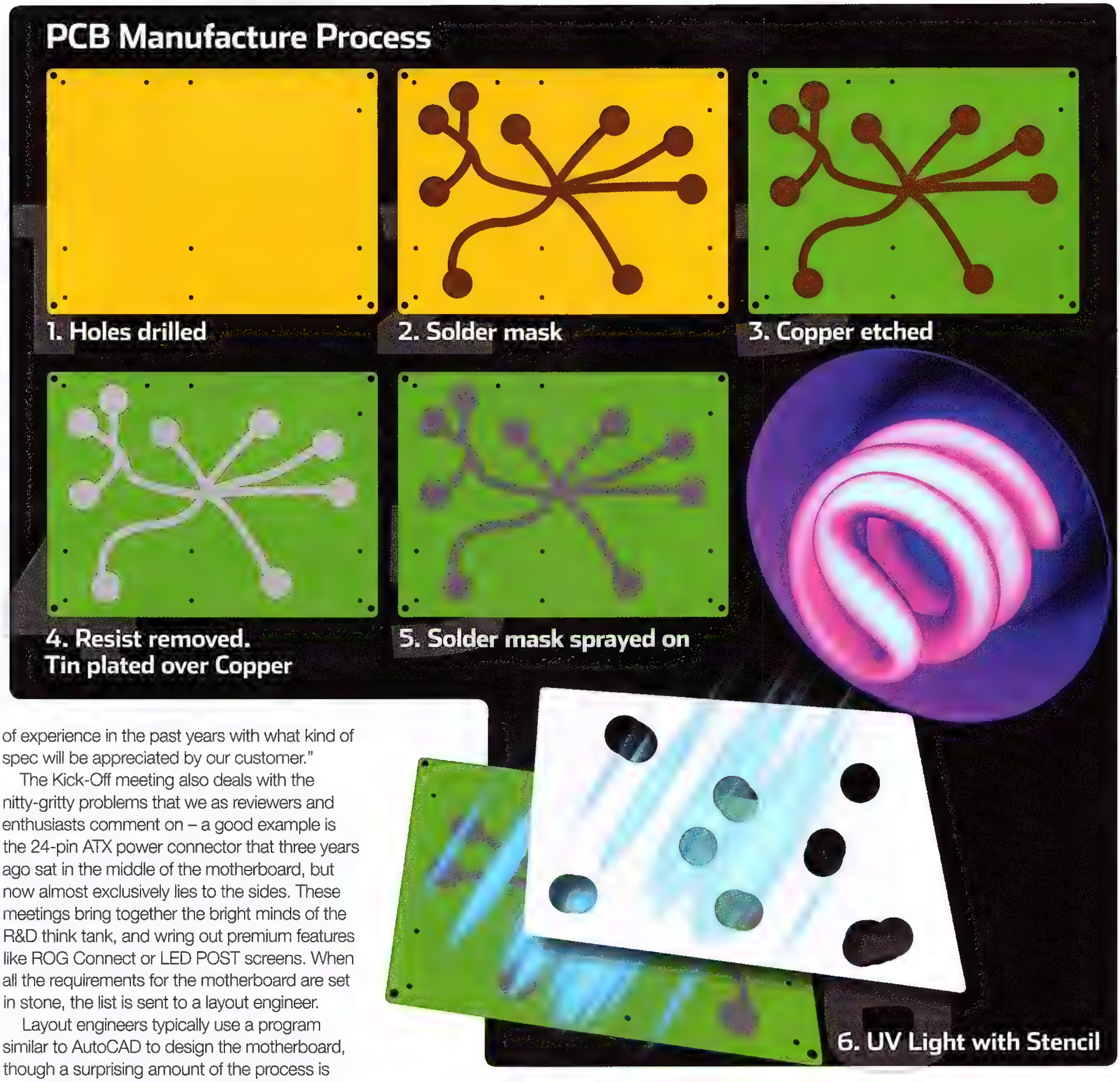
Engineers moved to take full advantage of this by including ever more components and features onto the PCB; it was the first time that Intel's 8008 processor was paired with 4K of DRAM. Storage needs grew and were met with new standards and connectors, processing and memory took on greater complexity, and the motherboard began to take its shape.

In the beginning

Before we get too ahead of ourselves, you may be wondering what happens as the very first step in motherboard production. We spoke with Albert Chang, the Senior Director of hardware Research and Development at ASUS (who flew out from Taiwan specifically to meet with us), explaining that the first step – before designing, manufacturing, or selling anything – is to throw an ASUS Kick-Off meeting. In the Kick-Off meeting, the specifications of the motherboard will be determined by the needs of ASUS customers. "Our colleague Product Managers will collect the requests from the market, we will talk to sales in every country, and we have a lot

These meetings bring together the bright minds of the R&D think tank, and wring out premium features like ROG Connect or LED POST screens.





PCB Manufacture Process

of experience in the past years with what kind of spec will be appreciated by our customer."

The Kick-Off meeting also deals with the nitty-gritty problems that we as reviewers and enthusiasts comment on – a good example is the 24-pin ATX power connector that three years ago sat in the middle of the motherboard, but now almost exclusively lies to the sides. These meetings bring together the bright minds of the R&D think tank, and wring out premium features like ROG Connect or LED POST screens. When all the requirements for the motherboard are set in stone, the list is sent to a layout engineer.

Layout engineers typically use a program similar to AutoCAD to design the motherboard, though a surprising amount of the process is done by hand. Albert explains that "the first thing we have to do is choose the placement of every component. The CPU, the DIMM socket, I/O and the PCI Express slot and any other components. Even the fan connectors and USB connectors must be in the right location and placement at the start of layout." Though this can be an intensive process for a new chipset or feature, some of the placement can be streamlined by copying existing circuit layouts into the design. Hunter Lee, a Product Manager from GIGABYTE, explains that their engineers maintain and utilise "an advanced database with many component designs; a circuit library. So from the beginning, engineers will use standard library designs and refer to chipset/component vendors' reference designs to make a 'Prototype' circuit." This allows a certain amount of shortcuts in each design.

Once these major parts of the design are in place, the layout engineer will begin to draw out the traces that connect the components together; replacing the cables originally used in computer design. We asked Hunter, who explained that "the designer needs to consider power consumption of the component. Higher power draw means you need a wider trace. Electronic 'noise' is also a concern, which might cause a drop in system performance." In addition to these considerations, some traces – particularly those that connect the DIMM sockets to the memory controller in the CPU – must be identical in length to avoid signal timing issues. For these situations, Hunter admits that "making proper trace lines [relies on] the experience of many engineers."

Albert wisely notes that the complexity of the design affects the number of layers used in the PCB – the more layers, the higher the manufacturing cost. When all the requests have been included and the design finished, a **GERBER file** is generated and sent to the PCB manufacturer. Both ASUS and GIGABYTE contract the manufacture of their PCBs out to other companies, but they're manufactured identically for both vendors and delivered at their respective factories for final assembly.

PCB manufacture

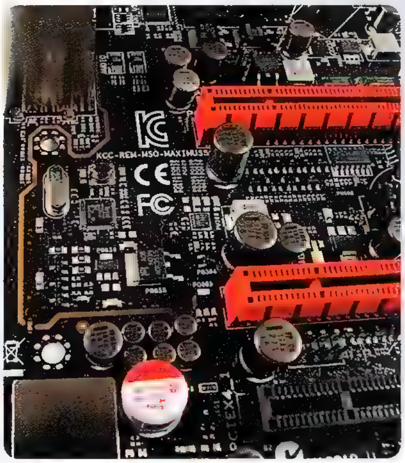
A PCB at its simplest consists of a single **layer**, which is typically a **thin sheet of copper** that has been heat-bonded to a thicker sheet of material called **pre-preg**. Copper thickness is measured in ounces per square foot; cheaper motherboard manufacturers will use one-ounce copper, while both ASUS and GIGABYTE have transitioned to two-ounce copper layers for better signal transmission. The pre-preg can

Design headaches

Designing a low-end motherboard with a handful of features is comparatively easy, as they involve only a few layers of PCB and are typically sparsely populated with components. However, high-end motherboards aimed at premium users can use eight or more layers and still run into cramping issues; made even worse by the very features that grant them access to high-end status. Most notorious of these is the NVIDIA NF200 PCI-Express bridge chip. It's a tiny little processor that takes 16 PCI-E lanes as input, and outputs 32 lanes.

The biggest problem that arises is the sheer density of traces required between the NF200 chip and the PCI-E slots – each slot requires 164 traces, and four slots mean 656 individual traces in a very small space. In addition to this, the NF200 chip causes its own headaches – Albert from ASUS explains that it consumes "more than ten watts," requiring that engineers "put a heatsink on the chip, even heatpipes, because the chip is very hot."

It's not just limited to the NF200; sound processors can also cause headaches when electrical interference from other components intrudes on sound output. Hunter from GIGABYTE explains that engineers use "separate grounding paths for both analog and digital audio signals." This avoids a lot of the design problems faced, but low-end chipsets from Realtek can still suffer from interference when paired with standard components – the GIGABYTE G1 series of motherboards use "high-class audio components such as Creative 20K2 codec, Nichicon audio capacitors and copper shielding to reduce any possible electronic noise."



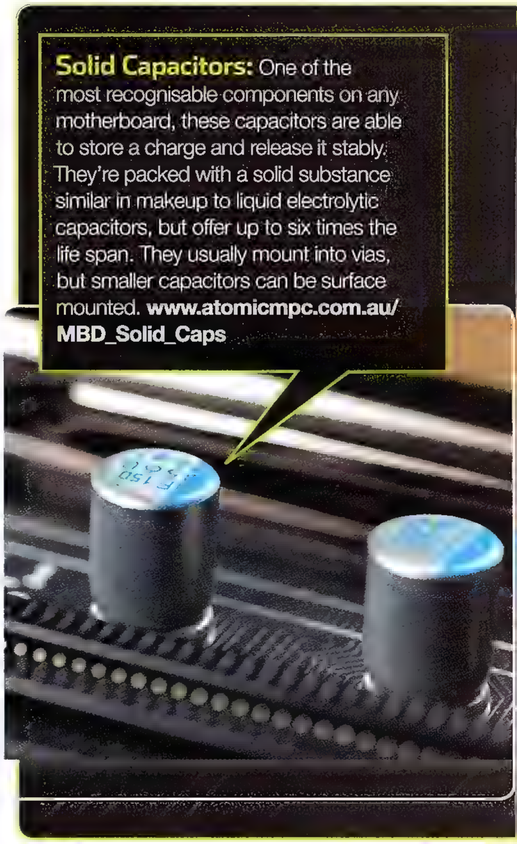
consist of a range of coded materials, but the most common for motherboard use is FR-4, which is a flame-resistant woven fibreglass matt, solidified with epoxy resin. While some types of pre-preg cure at room temperature or with exposure to light, the PC industry uses a more stable form that only cures when heat is applied.

Once the copper has been sandwiched to a layer of pre-preg, the board moves to a CNC drilling machine where holes are created for mounting to a case, and for machine manipulation on the assembly line; these are the holes at the corners of your motherboard that don't appear to have a purpose. Additional holes, called **vias**, are also drilled for component mounting. The copper is thoroughly cleaned with a bath in acetone to remove any possible grease or dirt, then rinsed in distilled water and buffed dry. A stencil created from the layout engineer's **GERBER file** is applied to the copper layer and sprayed with a **dry-film resist** using a technique called **silk-screening**. The resist is a substance that protects the copper from exposure to tin through the next few processes, and the areas of copper that are left bare mirror the traces exactly.

Now the copper is electroplated with a thin layer of tin in a process called **pattern plating** (see boxout pg28), protecting the copper from corrosion. The dry-resist is washed from the rest of the board, revealing a bare copper surface with thin tin lines across it. Unprotected copper is chemically stripped from the board in a process known as **etching**, done in a large scale by immersing the boards in a vessel with a liquid, commonly hydrochloric acid, and stirring the solution to pass the liquid over the copper, accelerating the etching process. This liquid will naturally contain quite a lot of copper once the process is finished; luckily the copper within can be recovered and re-used to create another layer of copper for yet another PCB.

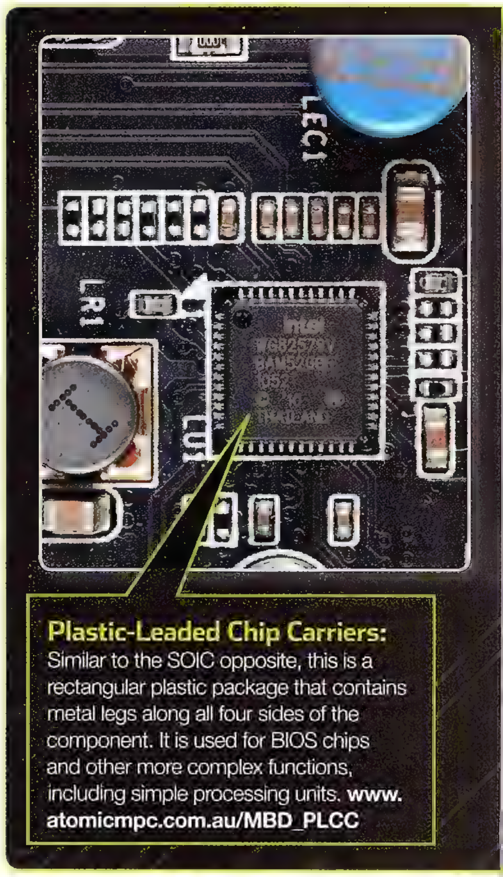
The board then goes through another coating process, this time with a lacquer-like material called **solder mask**. Its function is to prevent solder from contacting any part of the board that it's not supposed to, also helping to protect the traces from moisture, and is essential for guaranteeing a functional board. The entire board is sprayed with a substance known in the industry as **Liquid Photoimageable Solder Mask**, creating an even layer. A bright UV light is shone onto the board through a film; the lit areas are exposed and render the LPSM non-functional, allowing solder to be applied to these areas, while the shadowed areas retain their solder-repelling nature. Any labelling is silk-screened to the board while the solder mask is still wet using a coloured ink that helps identify components. The board is heated to 150ºC for an hour to cure the solder mask, hardening it and making it very difficult to remove.

Passive



Solid Capacitors: One of the most recognisable components on any motherboard, these capacitors are able to store a charge and release it stably. They're packed with a solid substance similar in makeup to liquid electrolytic capacitors, but offer up to six times the life span. They usually mount into vias, but smaller capacitors can be surface mounted. **www.atomicmpc.com.au/MBD_Solid_Caps**

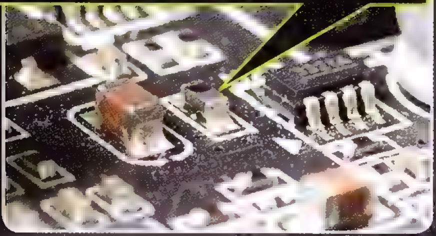
Active



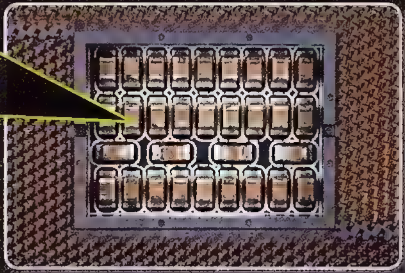
Plastic-Leaded Chip Carriers: Similar to the SOIC opposite, this is a rectangular plastic package that contains metal legs along all four sides of the component. It is used for BIOS chips and other more complex functions, including simple processing units. **www.atomicmpc.com.au/MBD_PLCC**

Types of mobo components

SMT Ceramic Capacitors: These function as energy-storage devices, and are able to absorb a fluctuating charge and release it as a specific, stable charge. They are manufactured with alternating layers of conductive ceramic and metal, with more layers being able to handle larger voltages. Nickel contact pads are added to the ends of the capacitors, which are coated in tin to prevent corrosion. **www.atomicmpc.com.au/MBD_Ceramic_Caps**

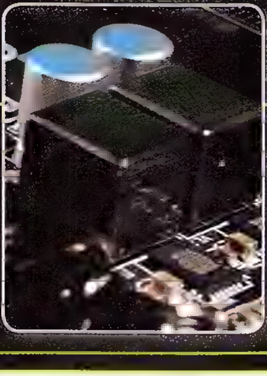


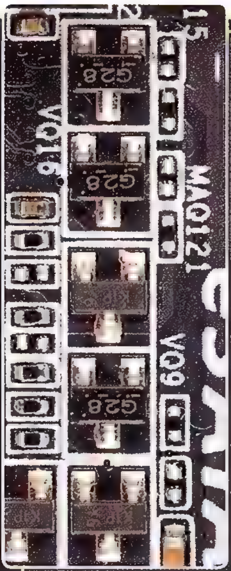
Tantalum Capacitors: Similar to ceramic capacitors, but instead manufactured from a metal called tantalum. A solid tantalum core is connected to a tantalum anode, with manganese dioxide, graphite, and silver placed between the tantalum and a cathode. Varying amounts of material affects final capacitance, and though these are more expensive than ceramic, they are much higher quality. **www.atomicmpc.com.au/MBD_Tantalum_Cap_PDF**



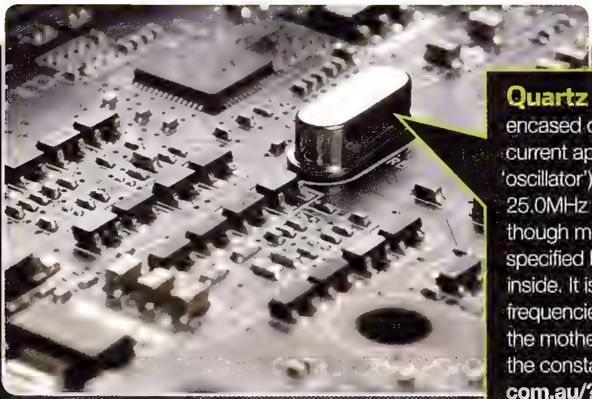
Thick-film Resistors: These are used to reduce an input current to a lower value, allowing the 12V and 5V power supply inputs to be used with all other components. Manufactured from a metallic ceramic material, the resistance is determined by the number of layers used in manufacturing. May require a heatsink if it absorbs sufficient current. Typically labelled with an "R" on the PCB surface. **www.atomicmpc.com.au/MBD_Resistor_PDF**

Ferrite/Iron Choke: Used for high-frequency noise filtering in power delivery systems, they are mounted through vias and consist of copper wire coiled around an inner core. If the core is iron the copper is typically exposed to the air, but if ferrite, the entire unit is sealed. Ferrite chokes offer higher efficiency and lower power, and are typically the first stage of a power phase. **www.atomicmpc.com.au/MBD_Ferrite_Choke**



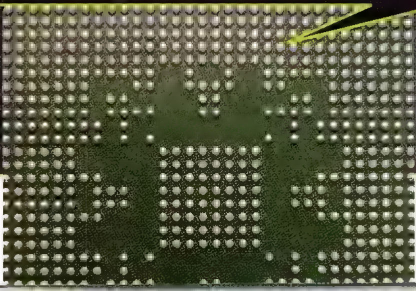


Small-Outline Transistors: Typically very small, and sometimes referred to as thyristors, these individual transistors are used for voltage regulation and switching purposes. They actively monitor for an input current and can respond in a very limited way, usually allowing current to flow to another device so long as the input current is maintained. Effectively, the SOT is a light switch. **www.atomicmpc.com.au/MBD_Thyristor**

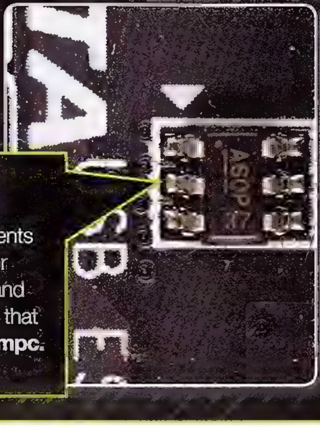


Quartz Oscillator: A small metal-encased crystal of quartz that has a current applied and turns on and off (hence 'oscillator') at a constant frequency, usually 25.0MHz for modern motherboards, though many other frequencies can be specified by changing the quartz purity inside. It is used to determine all other frequencies of processors and interfaces on the motherboard by multiplying or dividing the constant oscillation. **www.atomicmpc.com.au/?81088**

Ball Grid Array: The method of choice for producing very complex components such as video processors and chipsets, this does away with metal legs and replaces them with a rectangular grid of solder balls underneath the component. The silicon processor connects to the grid of balls with vias through the silicon. This is matched with a grid of pads on the motherboard, and is the most reliable way to mount SMT components. **www.atomicmpc.com.au/MBD_BGA**



Small-Outline Integrated Circuits: Small rectangular chips that contain a tiny silicon processor encased in plastic or, if thermal requirements are high enough, ceramic. The processor is used for exceptionally basic functions such as LED driving, and communicates with the motherboard via metal legs that extend along each side of the SOIC. **www.atomicmpc.com.au/MBD_SOIC**



Pattern vs Panel Plate

The earliest method of creating traces is known as Panel plating, where the entire copper layer is coated in a layer of tin, a coating of dry-film resist is applied with an inverted GERBER stencil, and then the whole board is etched, leaving behind thin copper traces covered in tin. This is a very intensive method of creating traces, and has the notable down-side of requiring more time to remove the large amount of excess material. This can be thought of as tin > film silk-screen > etch.

The more modern way to do this is Pattern plating, where the GERBER stencil is applied and resist added, then the copper is etched away to leave thin traces that are electroplated with tin. This method is film > etch > tin > silk-screen, which is much faster and requires less electrical current. Though pattern plating does leave inconsistent thickness in the tin layer deposited onto the copper traces, it is not thought to be a particular problem.

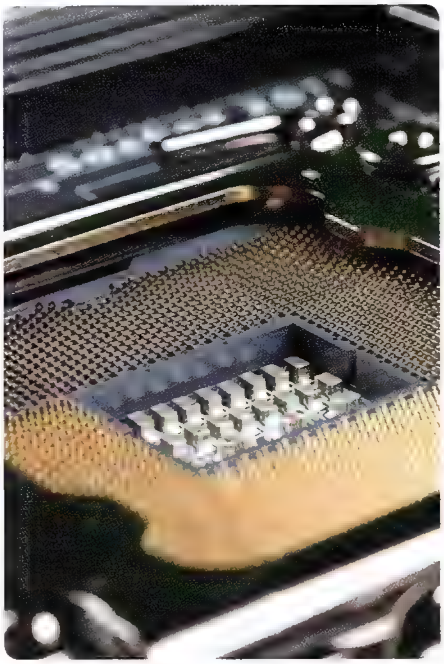
Assuming the manufacturing process up until this point has gone flawlessly, we should be left with a single layer of Printed Circuit Board. However, a single layer is particularly constrictive when it comes to creating a modern motherboard – there's just not enough room to fit all the bits in. This is where multi-layer PCBs come into play; by placing a non-conductive layer of fibreglass epoxy between double-sided layers of PCB, layers can be manufactured, then stacked and cured together to create a single multi-layered board. Stacking layers can result in boards anywhere from four to 20 layers thick!

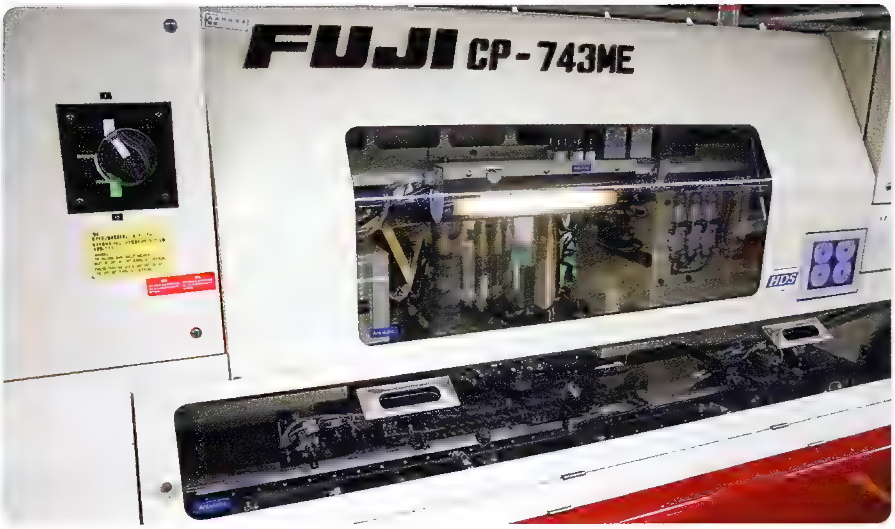
Putting it all together

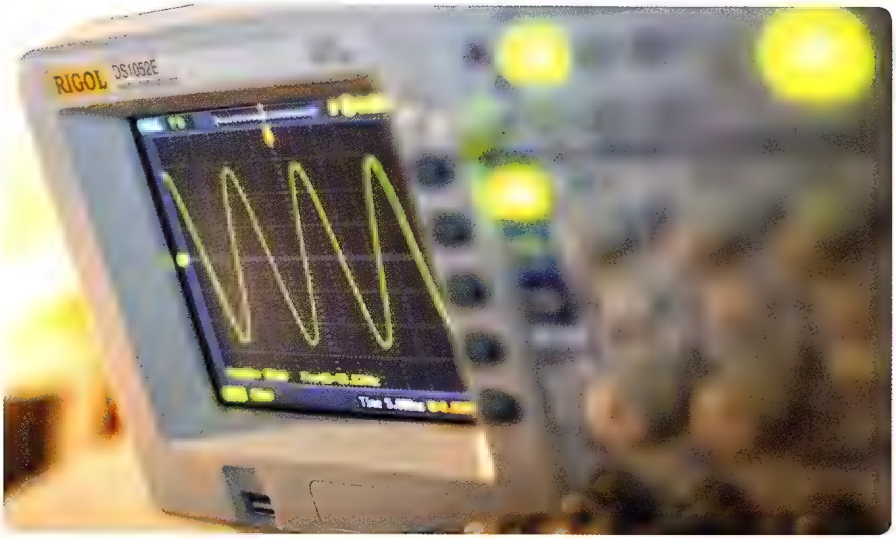
Once the PCB has been created to the layout engineer's specifications (as described in the GERBER file), it is delivered to the motherboard factory to be turned into a working piece of technology. A PCB by itself is not particularly useful; it's like a bundle of cables in a box, with nothing plugged in. Because the motherboard is so complex, requiring up to 2000 individual components for a standard mainstream board, between 85-90 per cent of these components are installed with a method called **Surface Mount Technology**. SMT is a modern technique that replaces the older assembly method used with the first circuit boards: rather than punching a relatively large hole in the PCB for every component, they can instead be mounted to metallic pads on the surface of the board. SMT components are not restricted to functioning only on the top layer of PCB, as they can be connected to inside layers with the use of vias drilled in PCB manufacturing, though typically this is avoided.

Manipulation and mounting of components is accomplished by the **Pick-and-Place SMT Machine**, a device that contains a series of arms with vacuum nozzles. After a quick silk-screening of solder paste to the areas that require it, the nozzles select components from a large wheel similar to a roll of tape, where each component is sealed in anti-static wrap, then the components are affixed to the board. Pick-and-Place Machines work so quickly that they can place thousands of components per hour – the essemtec Cobra (in action: **www.atomicmpc.com.au/MBD_Cobra**) can place up to 21,000 components per hour with its eight nozzles!

After roughly five minutes, the PCB has had the allotted SMT components affixed and it moves on to the **first pre-heating stage**, where the board temperature is slowly and evenly raised by super-hot air convection to a whopping 300ºC. This melts the SMT components into the solder paste, and roots them firmly in place. The board is allowed to







cool to room temperature, then moves to the **Manufacturing Defect Checker** that passes a small amount of current through the SMT components to ensure the circuits function as intended, and that there are no shorts. If the board requires SMT components on both sides, it is flipped 180° and goes through the process again.

Assuming the board passes, it's moved on to the next stage of assembly where **Dual In-line Package** components are installed on the board by machines similar to the Pick-and-Place. These DIP components are typically rectangular with metallic legs running down both sides, and control functions such as BIOS and other interfaces. Other important components such as PCI-E sockets, DIMM sockets, USB and Ethernet ports are added manually by hand in a line of factory workers. The reason for this is flexibility; it takes too long to re-program a machine to do this task for different designs, so people are used. The DIP legs and socket pins are inserted into PCB vias, then move on to the **Wave-Flow Solder Machine**.

The industry has entirely switched to lead-free solder, most typically a blend of 99 per cent tin with small amounts of silver and copper.

This machine contains three stages navigated by a conveyor belt: **pre-heating**, where board temperature is slowly raised to between 206-280°C; **flux spray**, where the board is sprayed with a chemical that aids heat transfer and prevents oxidising; and finally **wave soldering**, where a continually-flowing waterfall of molten solder coats the legs of components at a precise height as they pass over. Due to recent regulations world-wide, solder cannot contain any lead as it's particularly poisonous – although it is fantastic as a solder material because of its propensity to attach to copper. The industry has entirely switched to lead-free solder, most typically a blend of 99 per cent tin with small amounts of silver and copper.

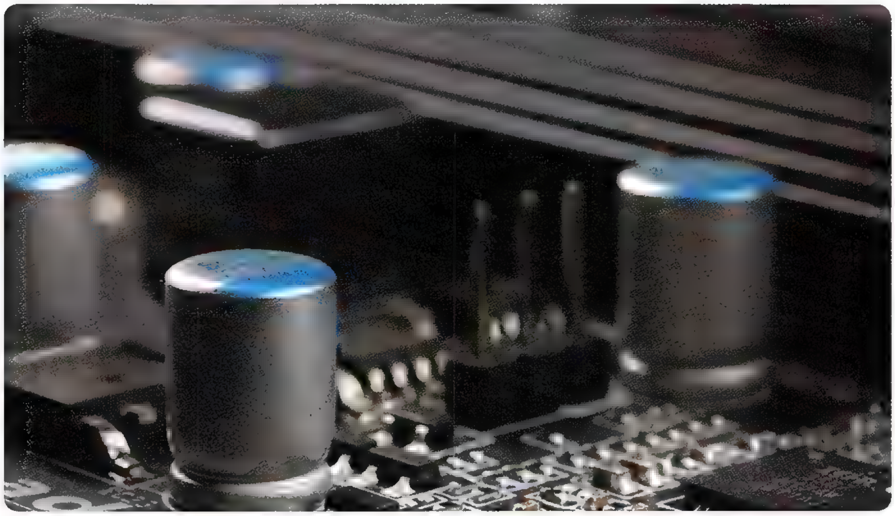
Allowed to air-cool once again, the board is inspected by hand and buffed clean of any excess flux or solder. The final pieces are added to the board: the CMOS battery that maintains user settings; the thermal paste or pads are applied to the chips that require them; and the various heatsinks and heatpipes that radiate the thermal energy away. The motherboard is now entirely assembled, but the manufacturer isn't done – not by a long shot.

Prototyping

For a new motherboard design, motherboard manufacturers will first order a run of 30-40 PCBs and assemble them to test each function of the board before hitting full-scale production. GIGABYTE do this in two initial runs, first with the Engineer Verification Test batch, then the Design Verification Test batch that incorporates any changes required from the EVT. The Process Verification Test is the third and final stage where the board design hits mass production. We did not receive more detailed information as to how GIGABYTE test their boards, though Albert from ASUS was more than happy to walk us through their prototyping process. "Before the Sample Run the BIOS software should be ready," he explains, "it is the most important part on all motherboards. We need the BIOS to boot to the operating system. So when we get the sample, the sample has everything on the motherboard, and we will try to boot it."

Each sample in the run is tested with a machine called SCOPE, which is analogous to a Cathode Ray Oscilloscope used in physics labs. While a digital multimeter is good enough to see if there is a voltage running through the traces, Albert warns that "If you just use a multimeter you cannot see the waveform of the signal. We have to make sure that all the signals meet all specifications, like PCI Express, USB, memory, signal spec."

Of the 30-40 motherboards in the sample run, over 95% must be functional within all tolerances for the design to be considered acceptable. From here the boards move to the ASUS Quality Test Compatibility team, where R&D employees install processors and memory sticks. "The QTC team will go to the market and buy the real devices," Albert explains. "They'll run Prime 95 and 3DMark Vantage in QTC with real software." If the motherboard chipset is not compatible with products sold at retail due to a new design of socket or chipset, Intel or AMD provide a tray of engineering sample processors. In the instance a fault is discovered with the prototypes, either a power delivery issue or an excessive electromagnetic interference problem, the layout will be modified and the entire process will happen again with the revised design. Assuming there are no problems, the sample boards move on to mass production testing.



Test, test, and test again

The ASUS mass production testing process can be described as four stages: Function Box 1; Function Box 2; Aging; OQC. Albert explained the first step for us. "For Function Box 1, we use the MS-DOS operating system, and we program the LAN MAC address, the 1394 MAC address, and we program the unique identification number. If the motherboard has an inbuilt graphics card we use a diagnostic program to test it." Function Box 1 also tests digital S/PDIF.

"We wanted the process to be very smooth," explained Albert, "so the operator puts the board on the station, the function box is lowered down and the components are pushed into the board. We have a lot of cables connecting the function to another standalone machine to test."

We questioned how many motherboards went through the Function Box 1 process in an average production run, and were told it was 100 per cent. "Yeah, every single motherboard," Albert boasts, "100 per cent of our motherboards will go through this process." We were certainly impressed.

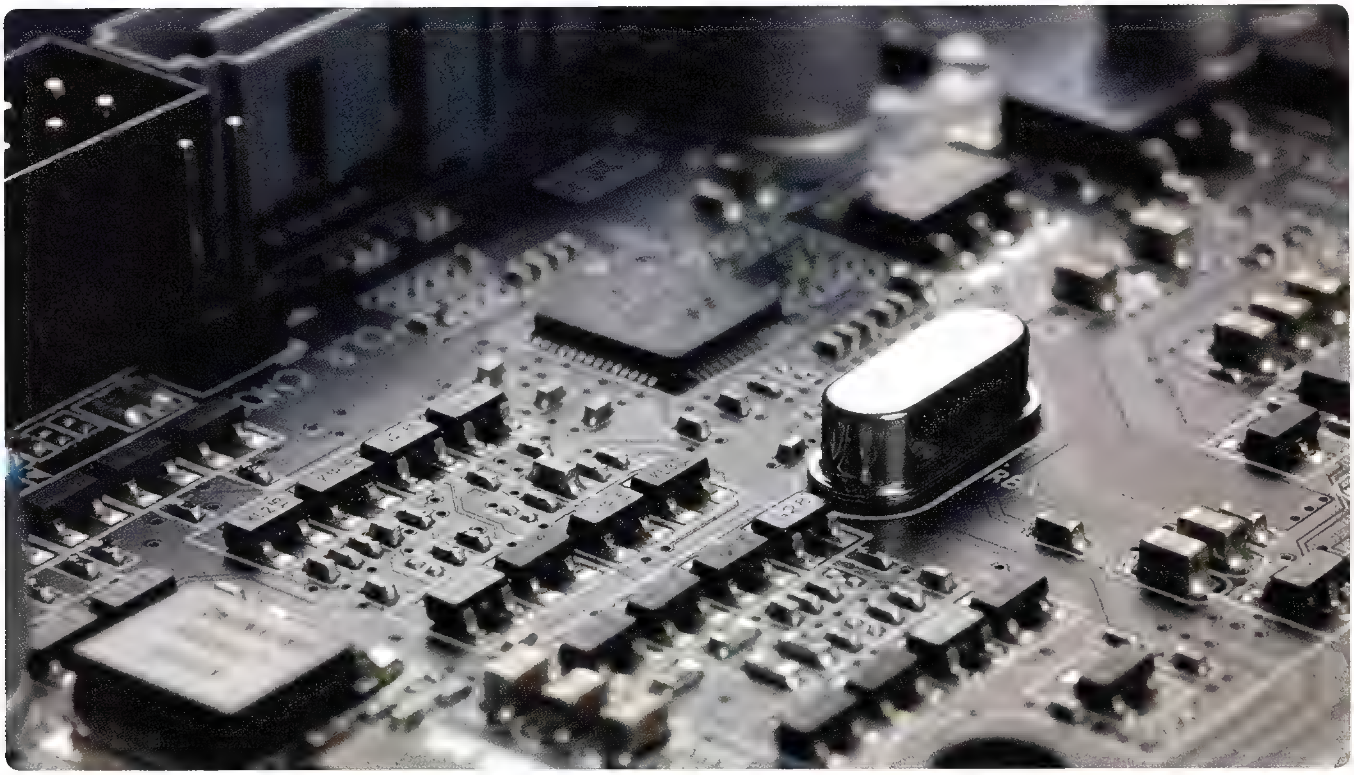
"Beside Function Box 1 we have Function Box 2. We use Windows 7 Operating System, so we have detailed tests that test all function; LAN, SATA, 1394, USB, audio." When we queried for clarification on the sound testing, Albert elaborated "Just the function. I don't think it's digital or analog, it's in the operating system. The real function of the components. We also check the UID again, because the Function Box 1 program may have had some problems, so we check it again because it's very important."

The Eye Check that follows is, as the name hints, a visual inspection of the motherboard conducted by a skilled employee. Major component placement will be checked against a reference board, making sure that the sockets and ports are all where they should be. They don't pull the heatsinks off, however: "The heatsink thermal pads should be in the previous stage when the operator put the heatsink on the board, he should check it's there."

The final test in Function Box 2 is the leakage of the CR2032 CMOS battery. "We want to make sure that the battery leakage is under 1uA to 12uA." This ensures that the date and configuration entered by the user will be remembered when the power is turned off. Function Box 2 testing is also completed for every single motherboard produced by ASUS.

Aging is the third stage in testing for ASUS motherboards, where 100 per cent of the sample run prototypes and 50 per cent of mass production boards will have their functions tested thoroughly. "We will do on/off tests for two hours, Gigabit Ethernet copy and compare tests for two hours, and run 3DMark Vantage for two hours." These tests are automated, and take just over six hours to run to completion.

The final stage in ASUS' testing regime is enacted upon only 10-20 per cent of boards



Testing failed!

In the rare event that a motherboard fails any of the ASUS testing stages, the board is immediately moved off the line and set aside for a production engineer to evaluate. "We want to process very smoothly, so if any motherboard fails we will drop it and have another operator fix it beside the mass production line," says Albert.

This isn't restricted to premium motherboards, and Albert reckons that every faulty motherboard will be inspected and a manual repair attempt made before chucking the board in the bin.

in a given mass production run, simply due to the amount of time all this testing takes to run. It is, of course, run on all the prototype samples. Called Output Quality Control, Albert explains "we want to try the user experience on our motherboard, so we use real Flash Disks and real Hard Drives or Speakers."

Though a hard question to answer, we posed that of time to GIGABYTE and ASUS: just how long does it take to create a new motherboard from scratch?

> "We will do on/off tests for two hours, Gigabit Ethernet copy and compare tests for two hours, and run 3DMark Vantage for two hours."

The answers were, naturally, complicated.

Assuming all the features have already been developed, and the chipset has been included in other products, both manufacturers agreed that it takes only 2-3 months to pump out a new model. However, Albert explained that for a new series, such as the upcoming ASUS Z77 motherboards – of which there are many models – it can take more than six months.

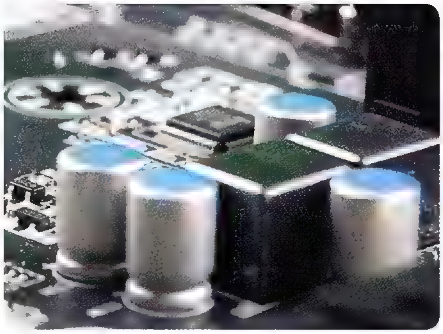
Looking forward

Motherboards are bound to change in the next five years. After all, technology moves at such a breakneck speed that it'd be naïve to expect otherwise. We asked GIGABYTE and ASUS for their thoughts on where the humble motherboard will go.

"Many users will notice that Chipset/CPUs have integrated more and more features than before," said Hunter. "For example, two years ago when USB 3.0 launched, all motherboard makers had to use NEC or AsMedia PCI-e x1 chips to implement this feature. But now, AMD FM1 (A75), or the upcoming Intel 7 series chipset already include this feature."

Albert agrees that integration is where the industry is headed. "The previous three-chip solution CPU, Northbridge, Southbridge, was changed to the two-chip solution for P55, CPU and the PCH. And I think Intel will continue doing that, they will combine a lot of functions in their chipset. But that's just for Intel's side.

"For our motherboard manufacture, we want to do more for the user, not limited to what Intel can provide. So we have two processors, the EPU (Energy Processing Unit) that is an energy-saver, and the TPU (TurboV Processing Unit) that manages overclocking. So we will use that in the next five, or even more than five years, to focus on the end-user needs."



The processing units are a notable feature that ASUS use on a large portion of their boards, and are based on the Intel 8051 processor architecture – a throwback to the computers of the 1970s. In an ideal world, Albert would love to talk with Intel for "a new interface between our processors and the Intel CPU," that would allow "a lot of power saving" and "overclocking more than Intel do."

As technology companies, neither are immune to buzzwords – but the cloud is definitely a trend that is going to continue. "We think the motherboard could be the 'Brain' for your house," explains Hunter. "With new software and hardware integration, users can remote access their personal info, or manage their home devices – all wirelessly and remotely." GIGABYTE has also recently announced a partnership with the instant-on OS Splashtop, giving the ability to access data from mobile devices.

Finally, both ASUS and GIGABYTE are working to pack in more connection standards to their boards and trickle them down to mainstream products. "We want to extend the PC application," Albert says, passionately gesticulating a mime of wireless data. "For example, we provide the Wi-Fi GO! feature in our Z77 motherboards; we want to extend the PC to your home, not just for playing games or surfing the internet."

Wi-Fi GO! is a simple wireless card, but its use is extended by the inclusion of DLNA software that allows streaming of media across the network to capable televisions and devices, and if you connect the PC by Ethernet to a network, it can function as an access point to connect laptops or mobile devices to the internet.

The final elephant in the room, and the storage interface on everybody's lips, is Intel's Thunderbolt. ASUS are looking at the technology very closely, but GIGABYTE came out guns blazing and stated that they "will release Intel Thunderbolt motherboards soon," describing it as "the future of external connection technology." With its 10Gbps maximum bandwidth (double that of USB 3.0) and the ability to pipe DisplayPort and PCI-E connectivity externally, it's being manoeuvred into place in the later stages of 2012 as the next must-have feature.

While we don't believe the form factors will change, motherboards will continue to evolve and improve. They'll be recognisable in five years, but the features they will offer – at significantly lower power consumption – will blow your socks off. Bring on 2017.

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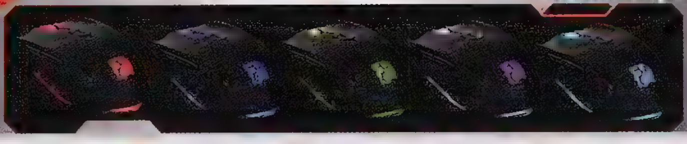

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HARDWARE

NEWS, REVIEWS AND ROUNDUPS ON THE LATEST HARDWARE

We've finally received the go-ahead to print information on the Z77 chipset, and to kick it off we have grabbed three motherboards sporting the shiny new chipset and previewed them in anticipation for the impending release of Ivy Bridge. Check it out!

On top of that new tech we have the NVIDIA GTX 680 card, the latest and greatest card from everyone's favourite green-coloured graphics manufacturer. It's a surprising release from a company with a history of bigger and hotter – the new card is neither of those things.

Then we've got our first in-house Head2Head in quite some time, as we look at eight cards from AMD's 7900 series. It's a busy month, and it all starts just over the page!

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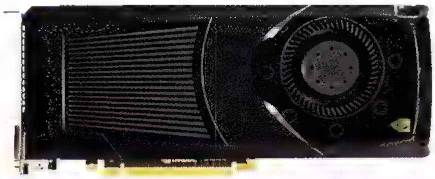

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HOW WE **TEST**

We do a lot of testing in our labs, and we look long and hard at every piece of hardware to determine whether or not it passes muster. From taking a new card out of its packaging, to bundled extras, to performance, every facet of a given piece of kit's 'user experience' is under scrutiny.

In some instances, we have tough benchmarks to help us rate gear. For a CPU or a graphics card, raw performance is, of course, the most vital stat as whether it stinks or smells like roses, as well as the ability to overclock well. But there are other things we pay attention to in the review process.

Value for money is an important consideration, especially in the current financial climate. High end gear is expensive enough as it is, so we look for good bundles. For instance, a graphics card that comes with a game or two, all the cabling you'll need, and little surprises like tools and other bumpf will score higher than a card that costs similar, but doesn't give you any presents.

Build quality is another thing we rate. From a PC case to a motherboard, we like our hardware well-made and capable of a taking a bit of punishment. We also like any included manuals to be clear and concise.

A lot of what we look for can be hard to put into numbers, we admit, but we try to think about what any enthusiast would think about their new gear after laying down money for it, installing it, and then using it.

And our benchmarks help, too. We've picked a suite of games and applications that anyone can get access too, so that you – the reader – can easily compare your own gear with the kit we have in each issue. In fact, we'd recommend to all our readers that they run all of these tests on their systems and save the results, so you can always have a familiar benchmark of your own to compare to the latest gear in Atomic.

UNIGINE HEAVEN 3.0

Our shiny Alienware-powered Gaming Lab, where we do most of our game reviewing and peripheral testing.

CPU Benchmarks:

Hexus PiFast

http://pifast.hexus.net/pifast.php

PiFast is a program that essentially calculates pi to a set amount of decimal places. It is a single-threaded application (one core/thread) and we run it at ten million places (10, 000, 000) using the Chudnovsky method, in the standard mode with no compression, and a FFT length of 1024kb. The program is free, so grab it and run it on your CPU. Memory bandwidth plays a significant role in the final performance of this program, so be sure you bump up the frequency as well as the CPU clock!

wPrime

http://www.wprime.net/

"wPrime uses a recursive call of Newton's method for estimating functions", says the website as it attempts to explain in plain English what it does. What it does do is, essentially, complex square rooting and other number functions, which are able to be split up evenly between multiple cores, or simply run on a single core. We use wPrime 32M in both single and multi-threaded runs. The results of the single run are divided by the results of the multi run, and this gives us the efficiency of the CPU being tested – very useful knowledge to have when comparing chips and evaluating the benefits of overclocking.

Cinebench R11.5 x64

http://www.maxon.net/downloads/cinebench.html

Cinebench is a stalwart benchmark, and is one of the more entertaining ones to watch. It focuses on rendering an image at 900 x 650 resolution, complete with ray-traced light effects and much more. It can be run in either singlethreaded or multithreaded mode, and efficiency is calculated the same way as for wPrime. The program also supports up to 64 threads in total, and watching eight threads with Sandy Bridge-E is quite impressive. The difference in performance between 32- and 64-bit is minimal – but really, you've got no excuse for not running x64. It's 2012 after all!

AIDA64

http://www.aida64.com/

AIDA64 is the spiritual follow-up benchmark to the original program by Lavalys, Everest. It's a system information tool that monitors voltage, temperature, as well as reporting on peripheral devices such as UPS batteries. Hardware and software model numbersare noted here, but perhaps the most useful part of this program is the memory benchmarks. Ready for the fastest quad-channel memory, this tests the read and write bandwidth as well as latency. The program is a small download, but keep in mind that you only get a thirty day trial until you purchase the full version for $40.

GPU Benchmarks:

Batman: Arkham City

http://community.batmanarkhamcity.com/

"Console port," you cry. "omg ur teh n00bs" and so on. But the important take-away from this benchmark is that Arkham City is a fantastic, modern example of a cross-platform game that features the latest enhancements to the Unreal 3 engine; an engine that's going to be around for a while yet. We run it at 2560 x 1440 with 16 x AA, 16 x AF, and record the FPS as we zip around Arkham as everyone's favourite bat-themed hero. If a product can run this at a smooth 60 frames per second, it'll run almost any Unreal 3 game.

Battlefield 3

http://www.battlefield.com/au/battlefield3

Gone are the days where Crysis is an appropriate benchmark for system performance; not only are we slightly bored of seeing the same scene over and over again, but newer games have been released. One of the prettiest is Battlefield 3, a game that commands a large, loyal following, in part due to its brilliant graphical engine: Frostbite 2. Featuring destructible terrain and shiny visuals, we run it at 2560 x 1440 with 2 x AA and 8 x AF. If a product does well here, it's going to be fine in basically every title in the forseeable future.

Unigine Heaven 3.0

http://unigine.com/products/heaven/

A synthetic benchmark built specifically to harness the latest and most demanding features of DirectX 11, Heaven is one of the best ways to test a card's tessellation capabilities. With a built-in timed run around a fully realised world, this benchmark taxes cards significantly and puts them under serious stresses. We test at a resolution of 2560 x 1440 using 2 x AA and 8 x AF, completing a run of the built-in benchmark. We set all the settings to 'extreme', including tessellation. This highlights how well the cards can handle DirectX11 features and what they'll be like in a game that takes advantage of those techniques.

3D Mark 11

http://www.3dmark.com/3dmark11/

It really wasn't that long ago that we were introducing readers to 3DMark Vantage, but the relentless pace of hardware creep has led to a whole new benchmark, 3DMark11. Designed to measure a PC's gaming performance, this latest version makes extensive use of all the new features in DirectX 11 including tessellation, compute shaders and multi-threading. We test using the Performance preset, which runs at 1280 x 720 with no AA or AF. This isn't the highest settings, but the free version of this benchmark can only use this preset; feel free to compare your scores with ours!

NVIDIA GeForce GTX 680

Matt Wilson flew to San Francisco to get the scoop on NVIDIA's newest beast.

Street Price TBA **Suplier** NVIDIA
Websites www.atomicmpc.com.au/136_NVIDIA
Specifications 1006MHz core; 1500MHz memory (6000MHz effective); 'Kepler' core; 1536 CUDA Cores; 2GB GDDR5; 256-bit bus width; dual-slot active cooling; dual 6-pin PCIe connectors.

1000 > 1215MHz
28% OC

The time has come for NVIDIA to finally show us their initial vision with Fermi, improving on many strong points of the architecture, boosting efficiency, and simultaneously moving to a smaller process. On paper, the GTX680 (codename Kepler) looks to be one hell of a GPU. It has 1536 CUDA cores, each one essentially the same as found on Fermi (just smaller), almost double the performance per watt, 6.0 GB/s memory bus, 1GHz core clock and 3.5Billion transistors.

It's the last part of that spec list that we're most interested in though, and with transistors being the building blocks of the GPU and its processing power, this is similar to measuring an engine's power by its cylinder capacity. Other factors in the GPU architecture do play a significant role in the overall power of the GPU, though the transistor count is a fairly good indicator of what to expect from a processor when comparing new tech to existing products.

By comparison, the GTX 580 has 3 Billion transistors, and for this reason, we only expected to see gains of around 16 per cent when compared to the GTX 580 at the same clock speeds. Of course the GTX 680 has a gap over the GTX 580 larger than 16 per cent, largely due to the 1GHz clock speed on the GTX 680.

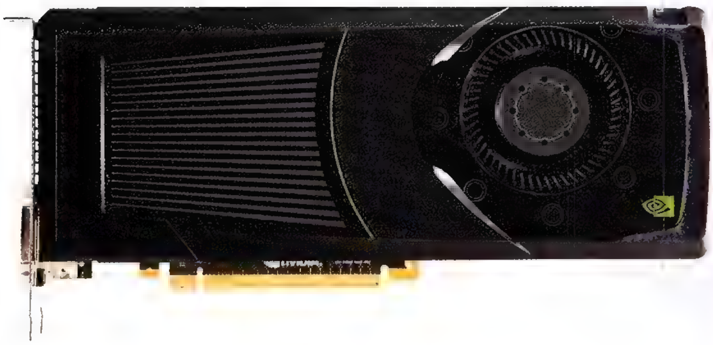
The Core

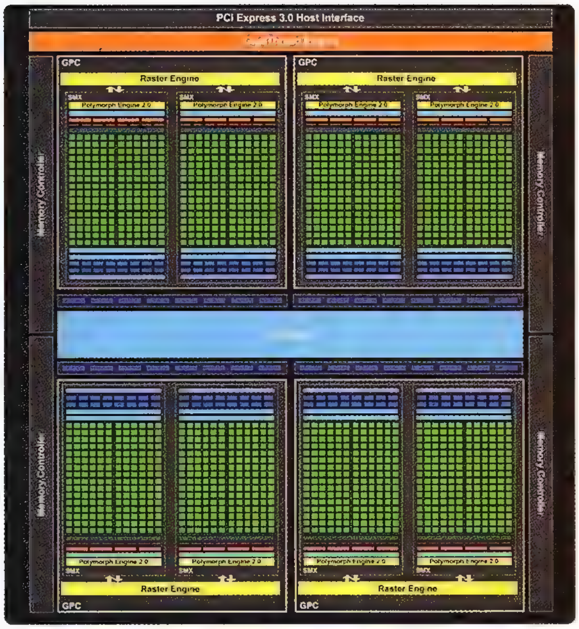
As mentioned, the GTX 680 has around 16% more transistors as a grand total. However, NVIDIA have increased the core count from 512 in the old GTX 580 to a very respectable 1536. Though the GTX 680 has an enormous core count, each core is made up of fewer transistors, making each core slightly less powerful than those on the GTX 580. Each GTX 680 core has roughly 230,000 transistors, while the GTX 580 was constructed with a far more significant 585,937 transistors at its disposal. This means that each GTX 580 core is nearly three times as fast on paper, and this is one of the main reasons why the three times greater core count on the GTX 680 has not converted into performance.

As for the physical size of the chip, 294mm² is the final measurement; this is significantly smaller than the GTX 580, which sported roughly 3 Billion transistors on a 520mm² chip. The reason for this is that NVIDIA has moved from a 40nm manufacturing process to 28nm, so that each individual transistor is smaller by 43 per cent. Given the much smaller size of each transistor and the chip itself, it's fairly safe to assume that the power requirements have also been reduced. NVIDIA claim a maximum power draw of around 195W, which as far as we can tell is fairly accurate. Compare this to the AMD 7970, and you should see a decent power saving. In our testing however, the 3D load consumption between the two video cards is extremely close.

Another way NVIDIA managed to cut back on power draw – besides employing a smaller 28nm process – was to simplify the architecture compared to the overly complicated Fermi. The NVIDIA design team removed the hardware-level scheduler from the process hierarchy, and moved the task to software. This is arguably less efficient in theory, though removing hardware simplifies design, reduces manufacturing costs and also reduces power consumption.

In order to make this transition work, NVIDIA had to spend a long time working on the software compiler and its efficiency. If this crucial part of the processor failed, or was inefficient,





the entire project would be dead in the water and NVIDIA would need to either fix the software issues, or go back to the drawing board and include a hardware-level scheduler and compiler once more. Luckily, their software-implemented solution has paid off.

GPU Boost

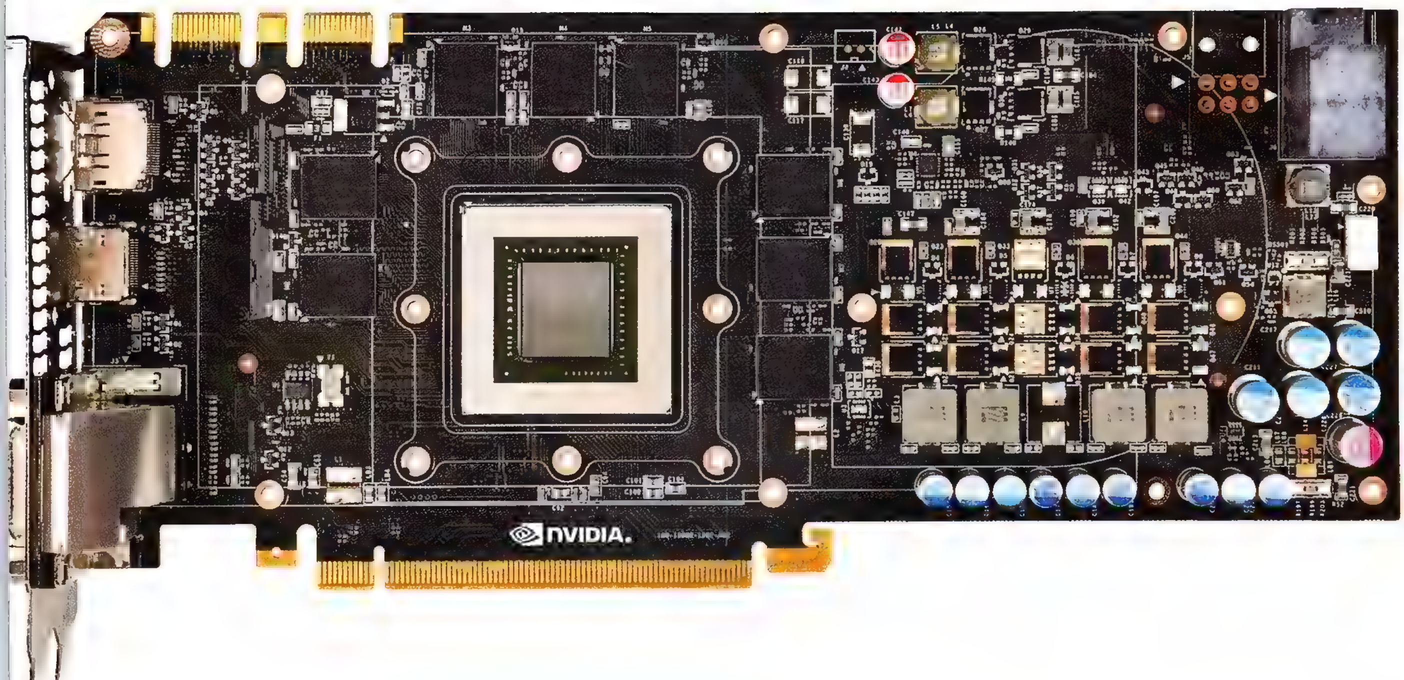
The good news is that with the 28nm process NVIDIA are now using, clock speeds can be increased and power consumption can be lowered. This has allowed NVIDIA to develop a new technology that monitors GPU load, clock speed, power consumption and temperatures. This technology is called "GPU Boost" and is best compared to Intel's "Turbo Boost."

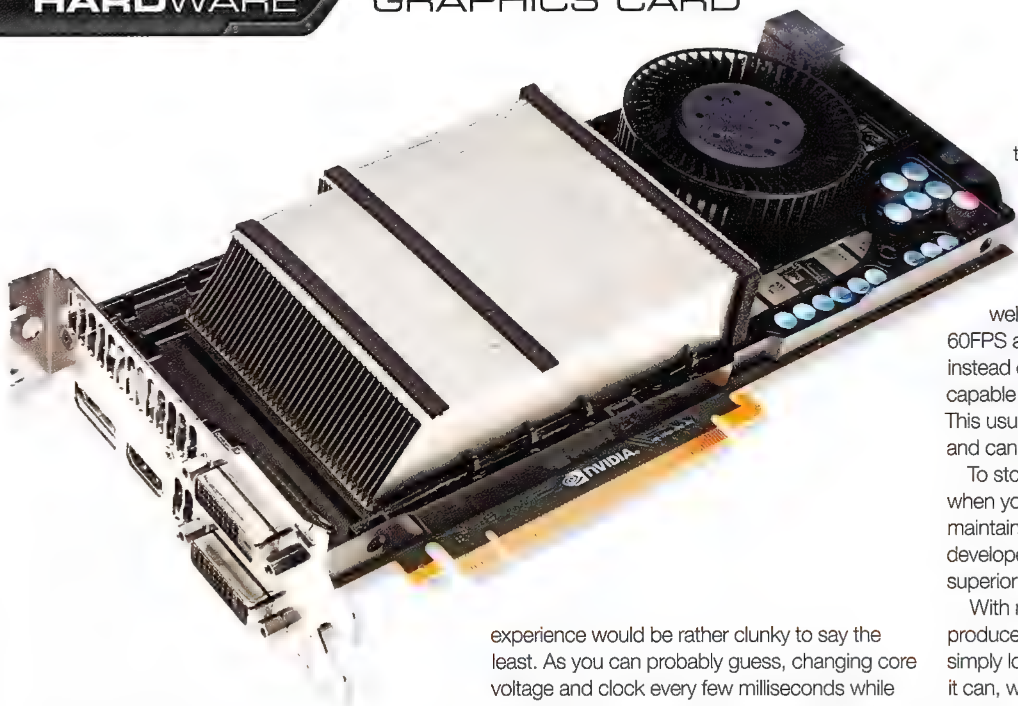
> If you set your clock ceiling to 1150MHz, yet keep power draw the same, the card will try to hit as close to 1150MHz as possible under 195W.

Essentially, the GPU driver monitors the card workload and sets a core voltage, fan speed and GPU clock to suit. So for 2D web browsing, you will likely end up with a core clock around 300-350MHz which can vary from card to card. Load up a light 3D application and you may see your "default" core clock of 1006MHz, or if this level of performance is not required, somewhere around 700MHz. Essentially, the core clock is no longer a static number, and now closely resembles a car tachometer.

As mentioned the "default" clock of each and every GTX 680 is 1006MHz, and this clock will be set for any workloads on the GPU over 20% (give or take). What the card can then do is take a look at the board power management system, check voltage, total power draw in watts, and thermals, and then apply a higher clock to the card. The card will set a higher core clock (1056MHz with default boost), though it will never pass 195W of total power consumption. Some cards may boost past 1056MHz if the GPU core is efficient enough or cooled well, though every card is guaranteed at least 50MHz boosts when needed.

This no doubt gets some of you thinking how traditional overclocking is achieved with this new GPU Boost technology. For most people, it actually makes life much simpler. There are two ways you can overclock with GPU Boost: you can either give the card permission to exceed the 195W limit (up to ~260W max), or you can set a new frequency limit within the card's current 195W ceiling. So for example, if you set your





new clock ceiling to 1150MHz, yet keep power draw the same, the card will try to hit as close to 1150MHz as possible while staying under 195W. The clock speed will continue to rise under load, until it is set too high and the card crashes. The remedy to this is to lower the clock ceiling, or increase the power available to the card.

Essentially, this new technology is designed for home users to play with their card in a more accessible manner. Set a clock or power limit, and let the card do all of the work. This is a great technology, and does help keep the card cool when idling, managing clocks and power balance while computing lighter tasks. Unfortunately, when overclocking past conventional levels, we experienced massive instability. This is due to the way this technology works on a fundamental level.

> 1215MHz seemed to be all that we were able to boost to. This equates to a 159MHz overclock, and to be honest it isn't really worth the hassle.

The Boost technology – in order to function effectively – needs to process data every few milliseconds and adjust core voltage and clock instantly to reduce any "lag" between clock changes and greater demand from the user. If they only updated clocks every few seconds, the experience would be rather clunky to say the least. As you can probably guess, changing core voltage and clock every few milliseconds while trying to benchmark at a 40% overclock isn't really helping anyone. For that reason alone, this card is sure to fail at extreme level overclocking, and arguably for some amateur overclockers.

For our sample, 1215MHz seemed to be all that we were able to boost to with any sort of reliability issues. This equates to a 159MHz overclock, past the default 1056MHz ceiling, and to be honest it isn't really worth the hassle.

Power draw goes up roughly 25 per cent to 45W, while performance only rose 1-10% over a range of applications. This removes most of the power advantage the GTX 680 has over the HD7970, and performs far worse than the latter when both are overclocked.

Adaptive Vsync

NVIDIA have also implemented GPU Boost as a "throttle" for their GPU that is controlled via a very complex sensory monitoring network. This throttle can be cranked up or pulled back depending on workload and power consumption; using the GPU core frequency to hit a requested frame rate.

NVIDIA have decided (and rightfully so) that regular Vsync in games is very… unrefined. With standard Vsync, the card will sync up with the screen refresh rate and will only attempt to display the frame rate the monitor can produce (usually 60Hz / FPS). This is all well and good. But what if you drop below 60FPS and the card can't produce more? Well, instead of just displaying 59FPS or whetever it is capable of, the card display will drop to 30FPS. This usually creates a short moment of "stutter" and can also affect gameplay.

To stop this constant jumping from 30-60FPS when your card isn't powerful enough to maintain a frame rate above 60, NVIDIA have developed their own version of Vsync, which is superior in practically every way.

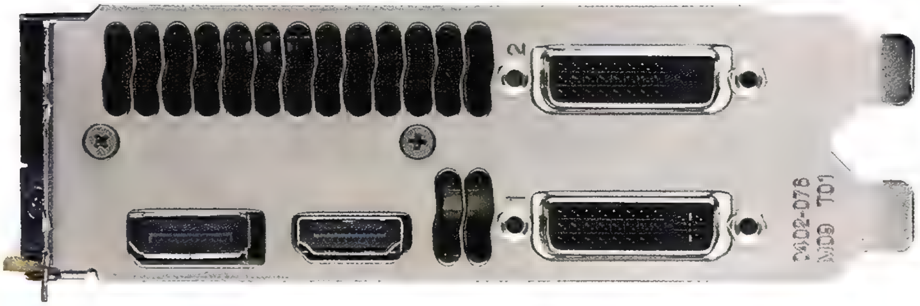
With regular Vsync, the extra frames produced above your monitor refresh rate are simply lost. The GPU is still working as hard as it can, while simply destroying any frames over the monitor refresh rate. Adaptive Vsync works differently. Instead of working at peak capacity, the GPU will manage its clocks and power draw

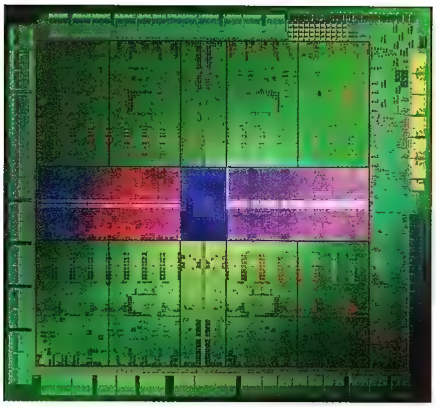
FXAA

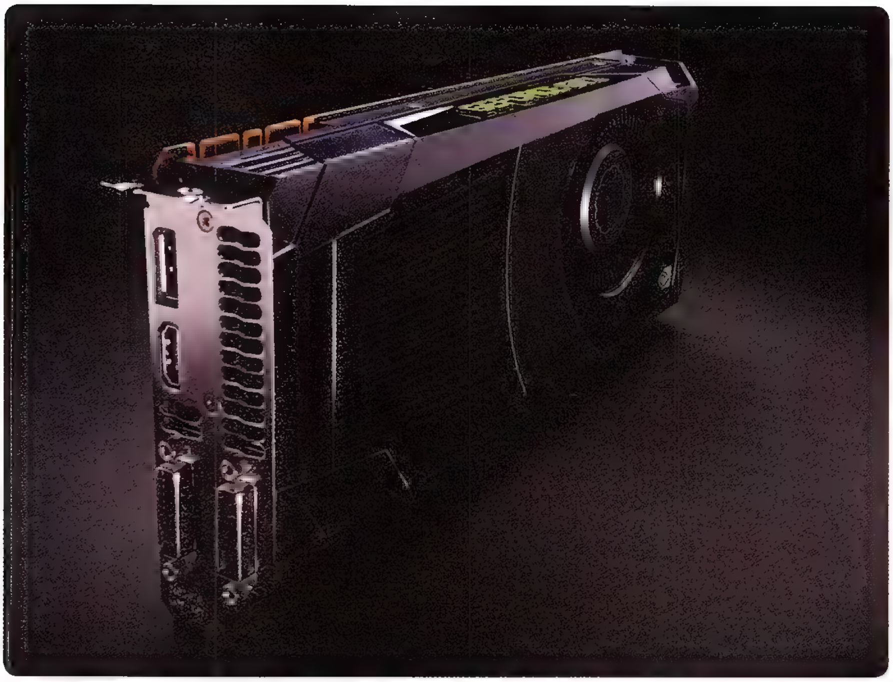
FXAA (Fast approXimate Anti-Aliasing) is a new form of Anti-Aliasing that is confirmed and supported on the GTX680. It's essentially a further "hacked" or altered filtration method first used by MSAA (Multi Sampling Anti-Aliasing). The way the FX AA works is it essentially smooths the pixels on the screen. It ignores polygons, lines and edges, and works on the final rendered image. What you end up with is a better blend of the colours, and not just black pixels next to white, with tons of jagged edges created by the rough transition between colours and pixels.

What this means is that instead of rendering each frame four, eight or even sixteen times to get a smoother edge to your image, you can now get similar or better results with only two rendered frames under FXAA. NVIDIA compared their adaptation of this new filter to the existing 8x MSAA. When running 2x FXAA, performance should be similar to that of 8x MSAA, and when running 4x FXAA (the maximum currently supported), performance should be well beyond any other comparable current filtration method.

In our testing FXAA did indeed provide the image quality of 8x MSAA **or better**, with just a fraction of the performance hit. The downside, however, is that not every game or application currently supports it. This is something that can be implemented via a patch or update, though it's likely not every game developer will do this. If your game does support this new filtration method, there is seriously no reason not to use this new technology.







to produce exactly your monitor refresh rate – a far smarter solution.

In our testing this technology worked without a hitch. Tearing was not an issue (the main reason for enabling Vsync in the first place), as 60FPS was maintained as a hard ceiling at all times. The frame rate stepped down perfectly, rising and falling smoothly and with minimal performance impact.

Multi Monitor

Multi Monitor gaming has become increasingly popular in the recent years, with AMD first launching Eyefinity, and NVIDIA shortly after coming to market with Surround Vision. In the past, NVIDIA's technology required you to install two video cards into your system in order to connect more than two screens, though this has all changed with the GTX 680.

It is now possible to connect up to four monitors to a single card, and connect them over "single display" mode, or individually. Due to how the four monitors sit on a desk, setting them all up in panorama will leave the "centre" of your viewing area as two monitor bezels, so we would suggest leaving the fourth monitor as an independent screen, not including it in panorama gaming or other eye-popping activities.

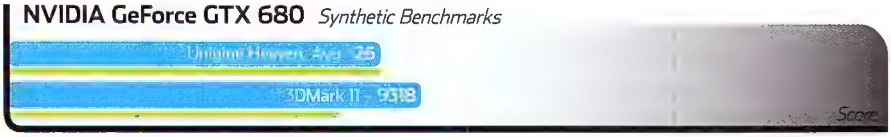
The Surround Vision solution is still a software/driver-enabled technology. It is not hardware-based like AMD's Eyefinity solution, so it is a little bit slower than the competition in that regard. Also, the fact that the GTX 680 only has access to 2GB of GDDR5 RAM, while the HD7970 has 3GB of GDDR5 RAM, also plays a role when comparing their multi monitor performance.

Admittedly we didn't have time to test this card over three screens in our labs, but we did play around with the card and multiple screens at the NVIDIA Editor's Day in San Francisco, where we were flown courtesy of NVIDIA. While it is a step up from previous NVIDIA multi-screen technologies, and does seem to run very smoothly in certain titles on a single GTX680, the same games were performing better for us using AMD hardware back home in the Labs. For example, Skyrim was being played at 5760x1080 at around 45FPS average on the GTX680, while we were getting closer to 52FPS average on the HD7970. Not a game-changing difference, but multi-screen gaming is still arguably NVIDIA's biggest weakness.

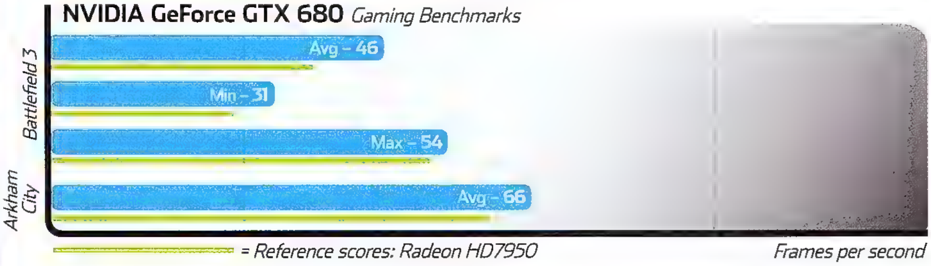
Tessellation

Compute performance on the GTX 680 is far more "efficient" on the GTX 680, in that you get higher performance for less power consumed, though in terms of raw "performance" it is actually not as fast as we were first expecting when compared to the GTX 580. It is undoubtedly faster, but given the fact that the core architecture is very similar to that of Fermi, and the transistor count is also comparable, it's not a huge surprise to see the gains are only around 20% on average when dealing with heavy compute and tessellation tests.

NVIDIA GeForce GTX 680 *Synthetic Benchmarks*



NVIDIA GeForce GTX 680 *Gaming Benchmarks*



That's not to say a 20% gain isn't fantastic, and it really is great, but after all the hype NVIDIA created around this product prior to launch, and the fact that it is coming to market roughly four months after AMD, we really expected a better performance in our Heaven benchmark. No matter which way you look at it, 2 frames per second above the 7970 isn't a whole lot, and depending on the price of the card, it may be something to consider when making your purchase. The 7970 likely performs close enough for your tessellation needs.

Is NVIDIA back on top?

GTX680 is a fantastic card, both on paper and in reality. Sure, it was a little slower to market compared to the AMD HD 7970, but it is here now and that is what really matters. As usual, your requirements should influence your purchasing decision. For anyone wanting the best card out of the box (we're talking about reference, stock speed cards here) the GTX 680 is the card to go for. On the other hand, if you are an overclocker, and seek speed no matter the heat or power then the 7970 is likely a better fit as it performs better at higher clocks. Though, if we were to take an educated guess at it, the GTX 680 may end up costing around $50 more than your average HD7970.

Cards have made it to Australian shores, and sit around $700 each, though stocks are extremely limited. You can make your own personal budgeting call. **MW**

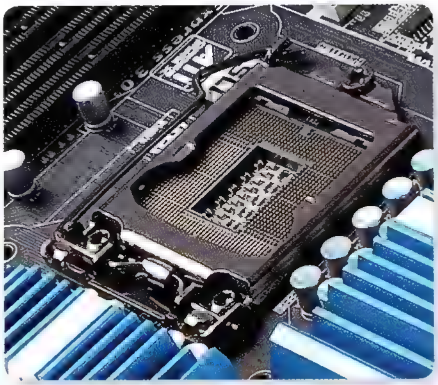
Intel Z77 Chipset Preview

We sneak a look at the latest and greatest chipset from Intel.

In many ways, the launch of Intel's Z77 chipset has been the messiest in recent memory. We actually pulled a motherboard review at deadline last month because we couldn't get a clear answer on when the official NDA date lift was, and it hasn't been made any clearer in the intervening month.

Part of this problem is that despite the fact that the Z77 chipset is here and ready to go, the accompanying Ivy Bridge CPU refresh isn't. The harsh reality is that it isn't compelling enough to upgrade to from the Z68, and though it has some interesting new features like PCI-Express 3 support and USB 3, there is nothing that makes it a must-have offering, or at least nothing a Sandy Bridge CPU and a Z68 motherboard doesn't already offer.

Even for overclocking, the Z77 won't really sing until Ivy Bridge. We were recently shown a slide during a presentation at MSI headquarters in Taiwan that indicated it had managed to get a 3.5GHz Ivy Bridge CPU running at 7.007Ghz on a GD-65 motherboard, although the specifics were blanked out. ASUS won't allow us to talk about any of the Ivy Bridge aspects of its Z77 boards, and neither will GIGABYTE (although we have heard whisper of it getting DDR3 RAM running over 3GHz on one of its Z77 boards).



That isn't to say Z77 brings nothing to the table. Far from it; it is full of incremental upgrades and a few new features that are really quite valuable. But they are, by and large, quality-of-life improvements that are not a radical leap over existing chipsets. Like the Z68, Z77 supports the use of Intel's processor graphics as well as overclocking of CPU, GPU and RAM. It also supports Intel Smart Response technology, enabling SSD caching – although with Z77 we expect to see much more usage of mSATA support to enable this caching.

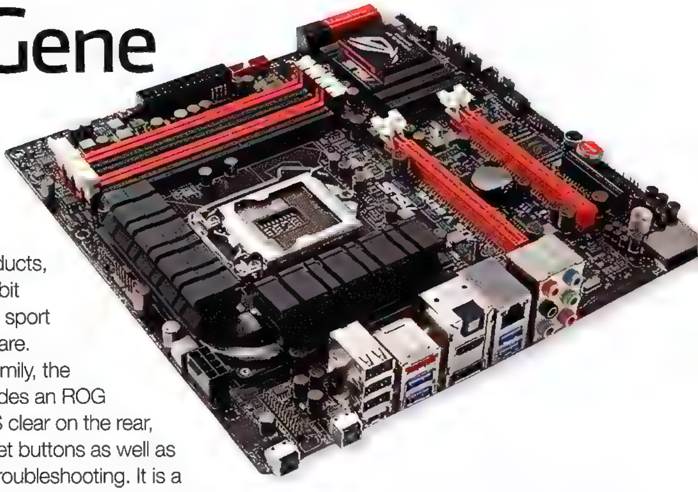
One of the biggest things that the Z77 introduces is chipset support for USB 3. It has four native USB 3 ports (and ten USB 2 ports) on-chip. Support for Serial ATA is unchanged from the Z68, with two SATA 6Gbps and four SATA 3Gbps ports. The Z77 also officially supports PCI-Express 3, but this requires both a PCI-E 3 Graphics card and a PCI-E 3 CPU (Ivy Bridge again), and won't deliver a noticeable benefit to end users in its current state.

We've had a look at some of the more interesting Z77 offerings from the big three motherboard manufacturers this month, but we don't feel that it is correct to review them based upon Sandy Bridge performance. Check back next issue when we'll have full reviews of Z77 chipset boards, the way they are meant to be. That means Ivy Bridge CPUs and a whole lot of overclocking, benching and other Atomicy goodness. **JG**

ASUS Maximus V Gene

Street Price TBA

Specifications LGA 1155; Z77 Express chipset; Micro-ATX; 2 x16 PCI-E (1 x 16x, 1 x 8x electrically); 4 x SATA 6Gbps, 2 x SATA 3Gbps; 1 x mSATA; 1 x mini PCI-E.



With the Maximus V Gene, ASUS continues its tradition of making well featured Micro-ATX motherboards for gamers and overclockers. Besides the array of features that come with the Z77 chipset, the MVG brings some extras to the table thanks to the use of secondary controller chips and some nifty design choices.

It supports four SATA 6Gbps drives (two native, two from the ASM1061 chip), and two SATA 3Gbps drives. One of the spare SATA 3Gbps channels is routed to a special riser card that comes with the board, which features an mSATA slot and a mini PCI-E slot (the PCI-E slot is designed for slim wireless modules). ASUS has included four USB 3 slots on the rear of the board as well as a header for two front panel ones, driven by an ASMedia ASM1042 controller.

Integrated graphics are pumped out through either a HDMI or DisplayPort slot on the rear, and ASUS engineers have included the new Lucid Virtu MVP technology to enable the use of processor graphics alongside a discrete GPU or two, thanks to dual x16 PCI-E slots. Unlike some of the higher end ROG products, the Gene uses an Intel gigabit LAN port. It does, however, sport Creative's X-Fi audio hardware.

Being part of the ROG family, the Maximus V Gene also includes an ROG Connect button and CMOS clear on the rear, with internal power and reset buttons as well as an LED POST readout for troubleshooting. It is a board that will be quite capable for both gaming and overclocking, although it is likely to follow other ROG products in being one of the higher priced models on the market.

Overall it's a well-featured board, especially for its Micro-ATX size. The riser card is by far the most interesting new feature on the board. Not only does mini PCI-E let the user choose just what wireless solution will work best for them (if any), but the mSATA slot is a handy solution for SSD caching through Intel Smart Response Technology. If you wanted to drop a chunk of money on a high-capacity SSD it could feasibly be the only storage within the system, which would facilitate some very interesting custom builds. **JG**

PROVISIONAL RATING

Good, but wait 'till you see it in an ITX form factor!

88%

GIGABYTE GA-Z77X-UD5H

Street Price TBA

Specifications LGA 1155; Z77 Express chipset; ATX; 3 x16 PCI-E (1 x 16x, 1 x 8x, 1 x 4x electrically); 5 x SATA 6Gbps, 4 x SATA 3Gbps; 1 x mSATA.

Sitting at the highest end of GIGABYTE's Z77 product lineup, the UD5H is a highly featured model that adds a few new twists on the old formula. The biggest of these is something that GIGABYTE engineers have added to the entire lineup of full-sized Z77 boards; an mSATA slot. On the Z77X-UD5H this sits between the CPU and the first PCI-E x16 slot, the same position we saw used on last year's Z68XP-UD3-mSATA.

The rest of the board is also very feature heavy, supporting dual graphics card setups thanks to a x16 PCI-E 3 and a x8 PCI-E 3 slot. There is a third slot at the base of the board that uses a x16 connector, however this is only wired for x4 and isn't designed to take a graphics card. In fact, not only is this slot only active with an Ivy Bridge CPU, but when it is populated, the speed of the other x16 slots drops to accommodate it. There is also a PCI slot for those who prefer to kick it old school, and three x1 PCI-E slots.

There are four SATA 6Gbps ports on the board, as well as four SATA 3Gbps ones (two native, two from a Marvell 88SE9172 chip). A single SATA 6gbps port is designed to pipe directly to the front panel, and sits next to the USB headers, as well as a 6Gbps eSATA port for rear use.

On the rear IO plane there are four USB 3 ports, driven by a VIA chip (the VL810), with the chipset-native USB 3 ports piped to the front panel. There are also four more potential USB 3 ports available through headers, driven by a second VIA chip. Also on the rear are D-Sub, DVI, HDMI and DisplayPort outputs, as well as audio, two USB 2, an eSATA and FireWire ports. The UD5H also has dual gigabit LAN ports, something that has fallen out of favour in recent years. One is driven by an Intel controller, while the other uses an AR8151 controller from Atheros. There is also going to be a variant of the Z77X-UD5H on the market that comes with a Bluetooth and WiFi card for those who want to connect their PCs wirelessly. **JG**

PROVISIONAL RATING

A good middle-of-the-road choice that we can't wait to test.

86%

MSI Z77-GD65

Street Price TBA

Specifications LGA 1155; Z77 Express chipset; ATX; 3 x16 PCI-E (1 x 16x, 1 x 8x, 1 x 4x electrically); 4x SATA 6Gbps, 4 x SATA 3Gbps; push button overclocking

The GD65 is the second-highest model of Z77 board announced by MSI, with the GD80 having a similar set of features but adding Intel's Thunderbolt technology to the mix. The GD65 is a well rounded offering, lacking the fancy features like mSATA seen on the ASUS and GIGABYTE boards, but not slouching when it comes to the basic feature set.

With native support for both SLI and CrossFire, the Z77-GD65 is another board that should be popular among gamers. Unfortunately due to the limitations of the Z77 chip, SLI and CrossFire will force the PCI-E lanes to run at x8/x8, and any boards sporting a 3-way setup will run at an even more constricted x8/x4/x4.

On the I/O plane sits two USB 3, one GbE, D-Sub, DVI, HDMI, four USB 2 and audio outputs. This is the only Z77 board we have seen so far that still has a PS/2 port as well. It has a total of four SATA 6Gbps ports on the board, with the extras driven by an ASMedia controller. There are also four SATA 3Gbps ports driven by the Z77 Chipset. There is a single USB 3 front panel header and 3 USB 2 headers. Also on the board are buttons for power, reset, and MSI's OC Genie technology.

The Z77-GD65 isn't too far removed from the Z68 offerings already available. The main changes are those found in the new chipset, and that largely involves I/O without any real benefits to overclocking or CPU efficiency.

Due to more and more operations and responsibilities now being moved onto the CPU, we really couldn't justify moving over to a Z77 board like the GD65 unless you have the specific need for native (and greater) USB 3, SATA 3 or PCI-E 3. These technologies are good, but usually a handful of USB, two SATA and a BIOS update for PCI-E 3 is all your Z68 board needs in order to get you ready for Ivy Bridge. **MW**

PROVISIONAL RATING

It's shaping up well, but we'd like a few more features.

84%

XFX HD7870 DOUBLE DISSIPATION BLACK EDITION

This may be the best card for mainstream users.

Street Price $409 **Suplier** XFX
Websites www.atomicmpc.com.au/136_XFX_7870DD
Specifications 1050MHz core; 1250MHz memory (5000MHz effective); 'Pitcairn XT' core; 1280 Unified Shaders (AMD); 2GB GDDR5; 256-bit bus width; dual-slot active cooling; dual 6-pin PCIe connectors; 1x HDMI; 2x Mini DP; 2x DVI.

atomic hotaward

The 7800 series seems to have come out of nowhere. It seemed like one day AMD were knocking on our door with a reference design card, and literally the next a shiny new XFX 7870 was waiting for us in our labs. The delay between engineering samples and actual retail product was almost non-existent which suggests that yields are high, and so is the confidence over at AMD.

As this is the first 7870 to appear on our pages, let's take some time to go over exactly what the 7870 is, and why it's such a great option for gamers on 1920x1200 screens. Essentially, this is just a "dumbed down" version of the HD 7950 (who'd have thought?) with a smaller core count and reduced memory bandwidth. The feature list however, is identical, offering all of the same features and technologies of the superior 7900 series.

Of course one of the most important gains this card has over the old 6970 is the new GCN architecture, providing up to 400% greater tessellation performance in some situations, and simply destroying the heaven benchmark compared to the video cards of old. This essentially means the 7870 card is the perfect replacement for the 6970, offering far greater performance, and due to the awesome yields AMD are experiencing, it does so at a price more than fair (even in Australia).

The card and cooler are a striking resemblance of the 7900 series from XFX, but that is not a bad thing. We love this cooler, and if it can help keep temperatures and prices down for XFX on the 7800 series as well, we have no issues with them re-using this cooler.

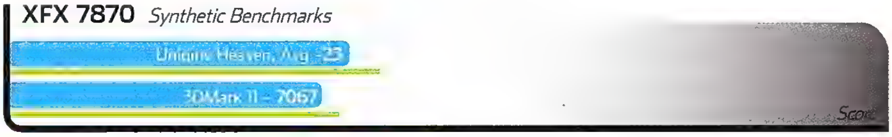
The 28nm core on this model is set to 1050MHz and the 2GB of Hynix GDDR5 memory is set to 1250MHz, both 50MHz bumps over reference. For the Stream processors AMD have gone for a 1280 core/32ROP design and a memory bus of 256-bit. PCIe 3.0, DirectX 11.1 and DirectCompute are all supported on this card, as is acceleration of high definition video content, and the card can output 7.1 audio over HDMI including DTS Master Audio and Dolby TrueHD.

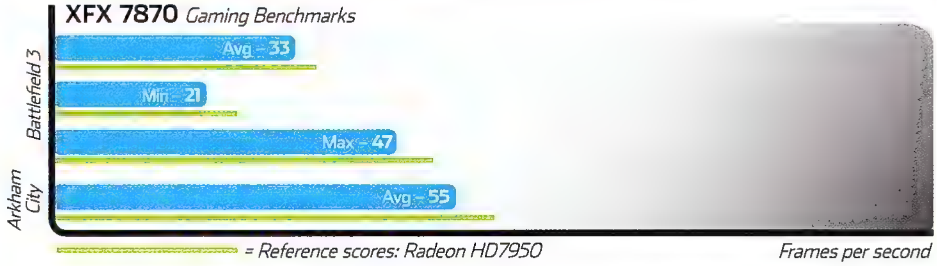
The card is powered by two 6-pin power connectors, giving the card a theoretical maximum power ceiling of 250W (not that it will ever use anywhere close to that). Regular power use seems to fall around 240W on our test system (3960X and four 1.65V RAM sticks), so it is noticeably lower than the 7970 and 7950. We'd hazard a guess as to around 150W is maximum power drawn from this card.

Overclocking on the 7800 series is a simple process; we open Afterburner, and from there we can begin moving the sliders to our desired speed, and even tweak voltages for additional stability at a cost of heat.

It seems the overclock to aim for on 7870 cards is 1250MHz core and 1450MHz memory, and our XFX sample reviewed today managed to go slightly higher. 1260MHz was reached on the core, and the memory reached a clock of 1500MHz without any problems at all. This brings performance up to the levels of a stock 7950, which in our opinion is a great success.

Looking to the build quality and design of this card, it is clear that XFX have improved on the reference design cards that AMD first launched. In this case XFX have used what appears to be a custom PCB with the much improved dual fan cooler. Essentially we can't fault the card, and for the price we are certainly happy with the results. **MW**


XFX 7870 *Synthetic Benchmarks*

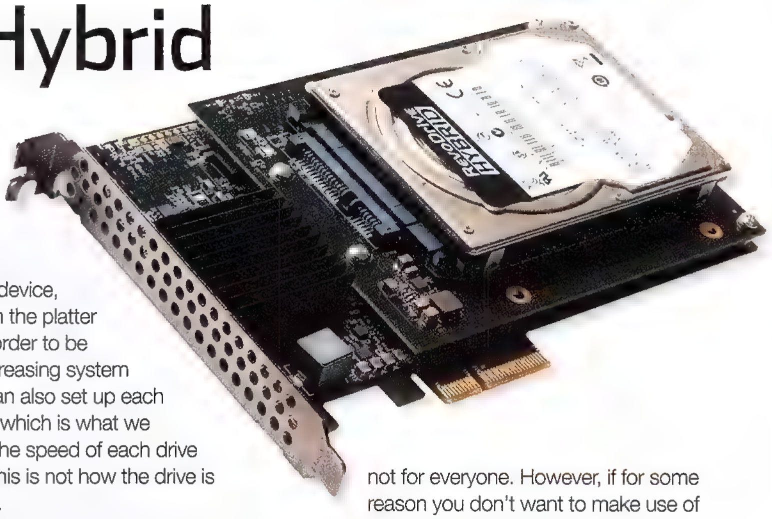

XFX 7870 *Gaming Benchmarks*

Performance	Overclocks very well, on top of factory clocks.	95
Bundle	Pretty standard fare.	85
Value	Very appealing, and a great choice for most.	95
Build	Quiet and stable, with great looks.	90
Overall	Well-cooled, overclockable, and affordable. What more could you want?	91%

OCZ Revo Drive Hybrid

A pricey, yet elegant solution.

Street Price $499 **Supplier** OCZ
Website www.ocztechnology.com
Specifications 1100GB Capacity, PCI-E 2.0, SSD + HDD Hybrid, 3-year warranty.



It's fun to come up with new pairings of technology. We've seen SSD storage before, we've even seen the use of system RAM as a storage device, but what happens when you marry an SSD and platter drive? The Hybrid is born.

The OCZ Hybrid isn't the first of its kind however, that honour goes to Seagate and the Momentus series. OCZ are however the first to implement hybrid drive technology on the PCI bus, giving a theoretical increase to drive performance without the restrictions of running two drives over a single SATA port.

Whether or not this idea has had any noticeable benefit over the Momentus drives was not clear to us before testing, but after plugging both drives into our system, we quickly got to work finding out whether or not OCZ's new release was worth pulling out a graphics card for.

As for how this technology works, it's rather simple, and essentially the same as Intel Rapid Storage Technology TM, just on a single PCB instead of over two separate drives. The SSD works as a caching device, and stores data from the platter drive temporarily in order to be quickly retrieved, increasing system performance. You can also set up each drive independently, which is what we did in order to read the speed of each drive individually, though this is not how the drive is intended to be used.

If you do set up each drive independently, the 1TB platter drive performs around as fast as your average 5,400RPM 5.25in hard drive, and really leaves a lot to be desired. The SSD however is around the speed of a OCZ Vertex II, give or take a few MB/s. So if for some reason you would like a decent 100GB SSD and a slow 1TB separate storage, it is possible to set up with this card, however we strongly suggest using Intel RST, and making the most of SSD caching.

So here is the burning question, is this drive worth owning? Well, to be honest you can buy a 100 GB SSD and separate 1TB platter drive for considerably less, so no, this drive is definitely not for everyone. However, if for some reason you don't want to make use of your 2.5in/3.5in bays, or already have them occupied, this drive is a fairly decent solution. **MW**

Overall
Decent speed, pity about the price.
72%

Corsair K90 Keyboard

Corsair continues its peripheral range with this MMO-focused board.

Street Price $159 **Supplier** Corsair
Website www.atomicmpc.com.au/136_Corsair_K90
Specifications Blue backlight; 20 key USB rollover; full anti-ghosting; 18 macro keys; USB passthrough; Cherry MX Red switches; volume and media control buttons

Over recent months, Atomic has reviewed various offerings from Corsair's peripheral lineup, and the last of these is the K90 keyboard, targeted at the MMO and RTS markets. It is a largely mechanical design, with Cherry MX Red switches used for almost everything; excepting the pgup cluster, function keys, and macros. This is a sensible approach that we suspect keeps costs down, while still providing some of the best linear mechanical action on the keys that matter.

Corsair's design is somewhat radical, with the keys sitting above a metallic baseplate. This means that the K90 isn't as much of a crud gatherer as most keyboard designs, as well as allowing for a quite striking splash effect when the blue backlight is activated. It connects via a solid, braided cloth covered USB cable, with two plugs. One drives the keyboard itself, while the other feeds a USB passthrough port. The keys themselves are coated in a matt black paint, which seems to be a lot more durable than it initially appears. It does tend to pick up a bit of finger grease during long play sessions, but we haven't seen any sign of it wearing down after several weeks of intensive gaming.

One of the nicest aspects of the K90 is that the 18 macro keys on the left side lay flat, effectively sitting below the angled level of the main keys. The macro functions themselves can be set on the fly or in software, however it is important to note that some of the more advanced functionality like recording mouse button presses wasn't yet implemented in the software when we tested it, though Corsair is working on adding functionality to the software.

The K90 really is a joy to use, not only is it one of the best feeling keyboards we've encountered thanks to the anti-ghosting, 20 key rollover and Cherry Red switches, but the metal plate, ancillary buttons and volume control are nice and responsive. As long as you keep in mind that the advanced macro functions are still beta, then this is a spectacular keyboard. **JG**

Overall
Corsair's roll continues with the K90, one of the finest gaming keyboards out there.
92%

GeIL Epicgear Meduza & Hybrid Pad

A mixed first showing from another memory manufacturer.

Street Price Medusa $89, Pad $25 **Supplier** GeIL
Website www.geil.com.tw/home
Specifications Mouse: Dual sensor, three modes (laser, optical, laser + optical); up to 6030dpi sensitivity; four DPI presets; 7x buttons (6x programmable); 5x profiles; 15x macro slots; 32bit ARM processor; 2m braided cable. Pad: textured weave on rubber backing.

GeIL is very well known for producing solid, enthusiast grade RAM, but it's also getting a lot of respect for its forays – like every other vendor and their dog – into gaming peripherals. It's a tough thing to pull off on the first attempt, too; it's taken the Thermaltake Tt eSports range a few goes to get to high quality; and while we love Corsair's new gaming gear, there are always some teething problems in the first range.

However, when John Gillooly returned from Computex last year, one of the things he raved about was GeIL's dedication to producing a great mouse. It's taken a while, but now we can see what he was going on about. We've also decided to look at these two products in tandem, as they are obviously designed to be used together.

> The upper surface is a combination of smooth gloss plastic and rubber insets, and it's quite comfy in general use, and very grippy.

The real talking point of the Epicgear Meduza mouse is what GeIL calls HDST, or Hybrid Dual Sensor Technology. The Meduza is not the first mouse to offer a combination of laser and optical sensors, but it is the first mouse we've seen to not only let you use both, but also switch between them. There's a simple switch on the bottom of the mouse that lets you pick your preference; we're not sure we can feel any real different between using either laser or optical sensor, but there are mousing aficionados out there who can and will drool over this kind of choice and flexibility.

Performance-wise, at least in full HDST mode, the Meduza really delivers. GeIL engineers built in a whole mess of features to deliver quite possibly one of the most precise gaming mice we've ever used. Its tracking is fast and smooth, and there's a lift-off cut-out at a mere 1mm (though you can tweak this, if it's not your thing) that makes lift-and-sweep movements a joy. Combined with some clever onboard algorithms to smooth out jitter, GeIL's really nailed it.

We played both strategy (Combat Mission) and FPS games (Battlefield 3) to test the Meduza, and in each it excelled, always leaving you feeling utterly in control of the action. We did test with just the laser or optical sensor engaged, and while on a range of surfaces the difference was next to minimal, we couldn't help but notice that it lead to a diagonal bias in cross-screen movement. However, if you stick with HDST mode, you'll be golden.

The Meduza's design is pretty elegant, though it may not be to some tastes. It's asymmetrical, for a start, so lefties need not apply with their sinister ways. The upper surface is a combination of smooth gloss plastic and rubber insets, and it's quite comfy in general use, and very grippy. There are two shallow grooves on the right-hand side for pinky and ring fingers, and it's more than possible to simply lift the mouse with just thumb and pinky. The grooves aren't perfect, though, and coming from Corsair's M60 fps mouse, we did feel it was a little on the awkward side.

The bottom surface is a unique fluoro orange, and the braided cable is a matching black and orange. It's a striking, aggressive look that doesn't go over the top.

The Teflon feet that the mouse slides along on are very cleverly rounded in profile, minimising contact with whatever surface you're mousing on. We used the Meduza on both the GeIL Hybrid Pad, and our standard Cooler Master hard shell, and to be honest... you really do get better performance from a solid surface. The GeIL pad is well made, with a seriously slick and fine weave, but we still felt more resistance from it than we'd normally like. It can also only be used in one orientation; if you rather your mat be positioned vertically up your desk, the weave becomes even harder to navigate.

Overall, GeIL's made a confident stride into this space. There are better mouse mat options out there, but the Meduza is a serious contender already. Its precision may not beat the sheer comfort of the Corsair M60, but that's purely a personal thing – we'd have zero qualms recommending anyone looking for a new mouse to give GeIL a try. **DH**

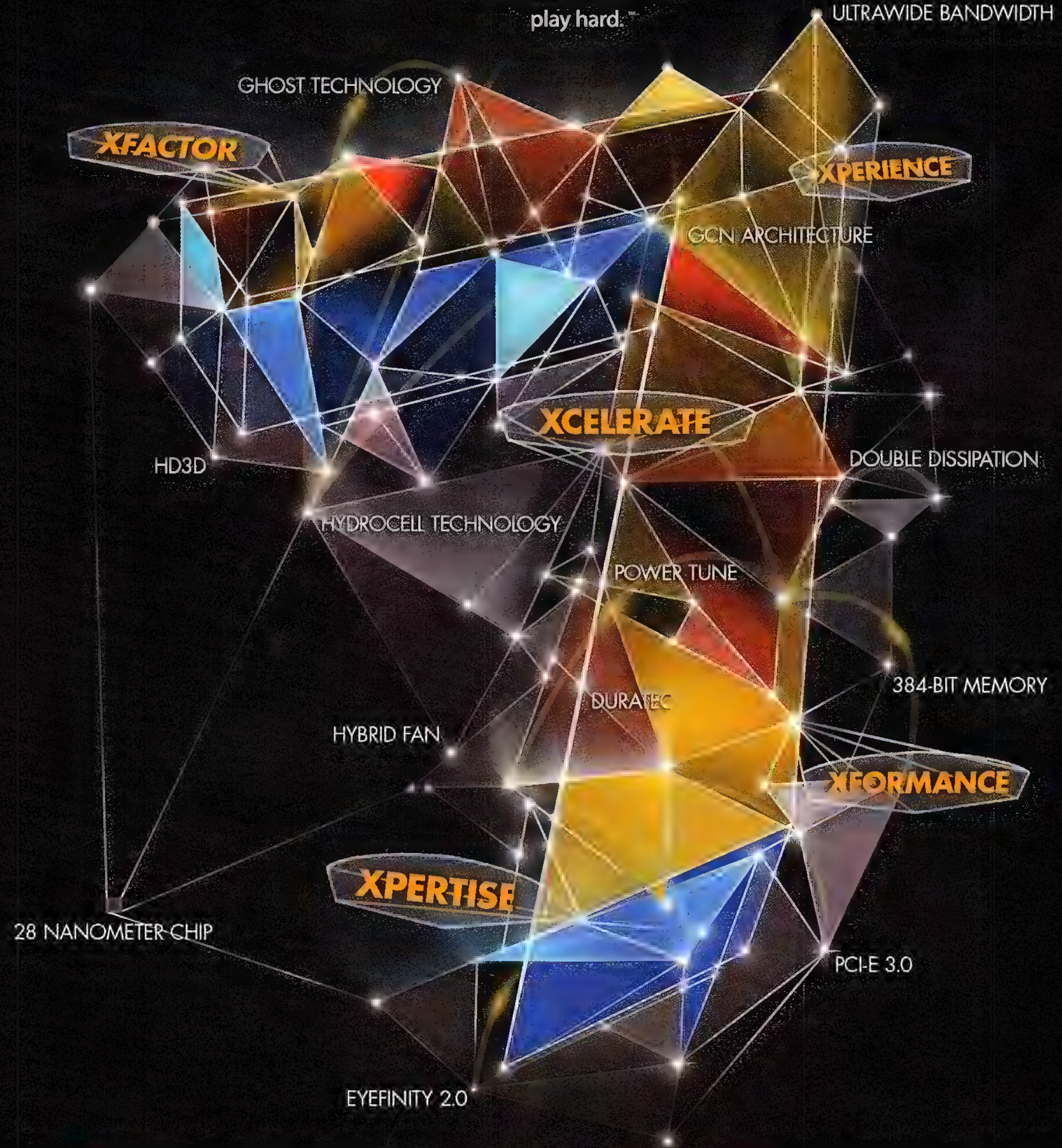
atomic hotaward

GeIL Epicgear Meduza
Great technology and precision.
92%

Hybrid Pad
Well made, but feels way too grippy.
79%

XFX

play hard.™



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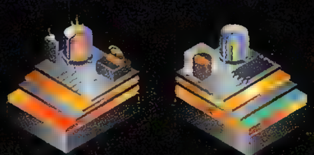

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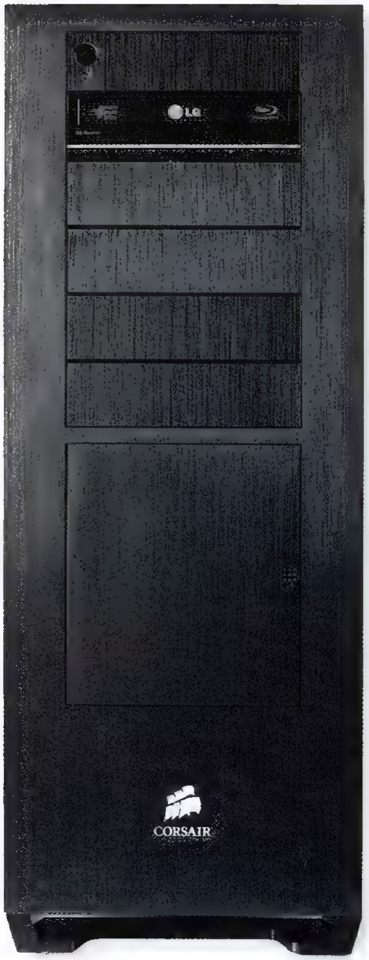
Scorptec Stinger Platinum

Top end components make for a top end price, but what a gaming beast this is.

Street Price $4599 **Supplier** Scorpion Technology
Website www.scorptec.com.au
Specifications Core i7-3960X @ 4.2Ghz; Gigabyte G1.Assassin 2; 16GB DDR3; 120GB SSD; 2TB HDD; Obsidian 800D case; 1200W PSU; 2 x GeForce GTX 580

While building PCs and tinkering with components is an inherently Atomic pursuit, there are times when it's nice to just leave the building up to someone else. Pre-built desktops tend to come in two major flavours, brand name systems built to restrictive specs and shipped to a store, or built in-house as a custom build from a local retailer.

Scorptec's Stinger Platinum is the latter kind of system – it's an enormously powerful piece of computing hardware that is built to order by Melbourne-based Scorpion Technology. This is its premium system, built around an overclocked Core i7-3960X CPU and SLI GeForce GTX 580 cards. It bears a high pricetag, but when you actually look at the specifications Scorptec has deliberately gone out and chosen best in class products in order to deliver an astonishingly powerful piece of hardware.



Not only is the Core i7-3960X overclocked to 4.2GHz, but it is cooled with a Corsair H80 closed loop water cooler. Straddling the CPU is a whopping 16GB of 1600MHz Corsair Vengeance DDR3, all plugged into a Gigabyte G1-Assassin 2 motherboard. That means an onboard X-Fi 7.1 sound chip and a Bigfoot networks Killer 2100 NIC Gigabit Ethernet card.

Everything is powered by a Corsair AX-1200 1200W PSU, which comes with an 80 Plus Gold rating and will be more than sufficient to drive the components in the system. The Corsair fetish continues with the choice of case, an Obsidian 800D.

Graphics duties are handled by dual EVGA 'Superclocked' GeForce GTX 580s running in SLI, with cores running at 797MHz and memory at an effective 4050Mhz. These cards are nicely spaced, with plenty of air left in between them, rather than sandwiched together. Scorptec has added a Wireless card in between the two cards, which is an addition to the base specification of the Stinger Platinum.

The EVGA cards are effectively NVIDIA reference designs, which means that they have full shrouded heatsinks – this is a good choice because we did find them getting toasty while benchmarking, and the shrouded design at least evacuates as much air as possible out the rear of the case.

This is handy because we were a little perplexed by the positioning of the fans within the Stinger. There are three Noctua 120mm fans mounted along the top of the case, exhausting air up and out. The only intakes however are the PSU fan, which acts as a closed loop thanks to its positioning in the lower rear of the 800D, and the radiator for the H80 cooler, which mounts on the rear of the case near the CPU. This means that, while the exhaust fans are great at removing hot air generated by the CPU, there isn't a huge amount of airflow coming up through the system itself. We can't help but think that shifting one of

In Unigine Heaven we saw an average frame rate of 46.8 fps and a maximum of 117.8. Our standard testbench delivered 35fps...

the exhausts to the grill on the base of the case and making it an intake would allow for a bit more airflow throughout the system itself. This is one area where the Obsidian 800D works nicely – its feet hold the base of the case a decent height off the ground, which makes an intake quite feasible.

While the system still worked perfectly fine, a little tweak like this could get temps down a bit lower than the 96 degrees seen on the second GeForce card when running GPU intensive benchmarks like Unigine Heaven. The temps aren't going to have any significant effect upon system performance but they will certainly make a dent on ambient temperatures after a while. The CPU temps were a lot more reasonable thanks to the H80, maxing out at 54 degrees under load.

Considering that this is our only real complaint with the Stinger Platinum it's actually a good thing. The choice of hardware is impeccable, and while a swap to GeForce GTX 680s would be good, they weren't available in retail at the time of going to print, and we suspect that Scorptec will update the system specs once there is a decent supply of the new cards coming into the country.

As for gaming performance, this is one monster system. In Unigine Heaven we saw an average framerate of 46.8 fps and a maximum of 117.8. Our standard testbench setup with a GTX 680 was pushing out an average 35fps in the same test.

In 3DMark11 the Stinger Platinum delivered a Performance score of P12509, with the GTX680 testbench delivering P9318 in the same test. While in Battlefield 3 we saw the Stinger Platinum hit an average 74fps, which was a glorious sight indeed, especially compared to the GTX 680's average 46 fps in the same test.

There is no doubt that this is an excellent gaming rig, delivering enough performance for all but the most demanding gamer's needs. It does sport a pretty monstrous pricetag, especially considering that you'll need to add at least a 2560 x 1440 resolution monitor and other peripherals to take true advantage of the under the hood grunt. But compared to brand name systems from companies like Alienware and ASUS it is competitively priced.

One of the things that contributes to the pricetag, and is no means a bad thing, is the choice of best in class parts for use within the Scorptec Stinger Platinum. It really is a robust assortment of components, and we would be hard pressed to find better bits with which to build a system ourselves.

Add to this the fact that the internals are clean, the cables immaculately arranged and the entire system was packaged up to minimise damage during transport and we have to give Scorptec big credit for showing how to do system building and shipping right. Not only where the graphics cards kept separated by foam blocks, but the entire inside of the system used an expandable foam pack to ensure that things didn't get knocked out of place when being mistreated in transit.

If you don't want to build your own PC, but still clamour for the best gaming experience you can buy, then the Scorptec Stinger Platinum is a wonderful gaming system. We'd suggest asking to have a fan moved from outtake to intake but that's the only change we can see. Even if you aren't in the market for such a costly system, this shows just how good the Scorptec team is at putting a PC together, which is reassuring even at lower ends of the scale. **JG & MW**

Performance
A Battlefield 3 monster.
95

Bundle
An excellent selection of quality components.
90

Value
Expensive, but reasonable considering the choice of parts.
85

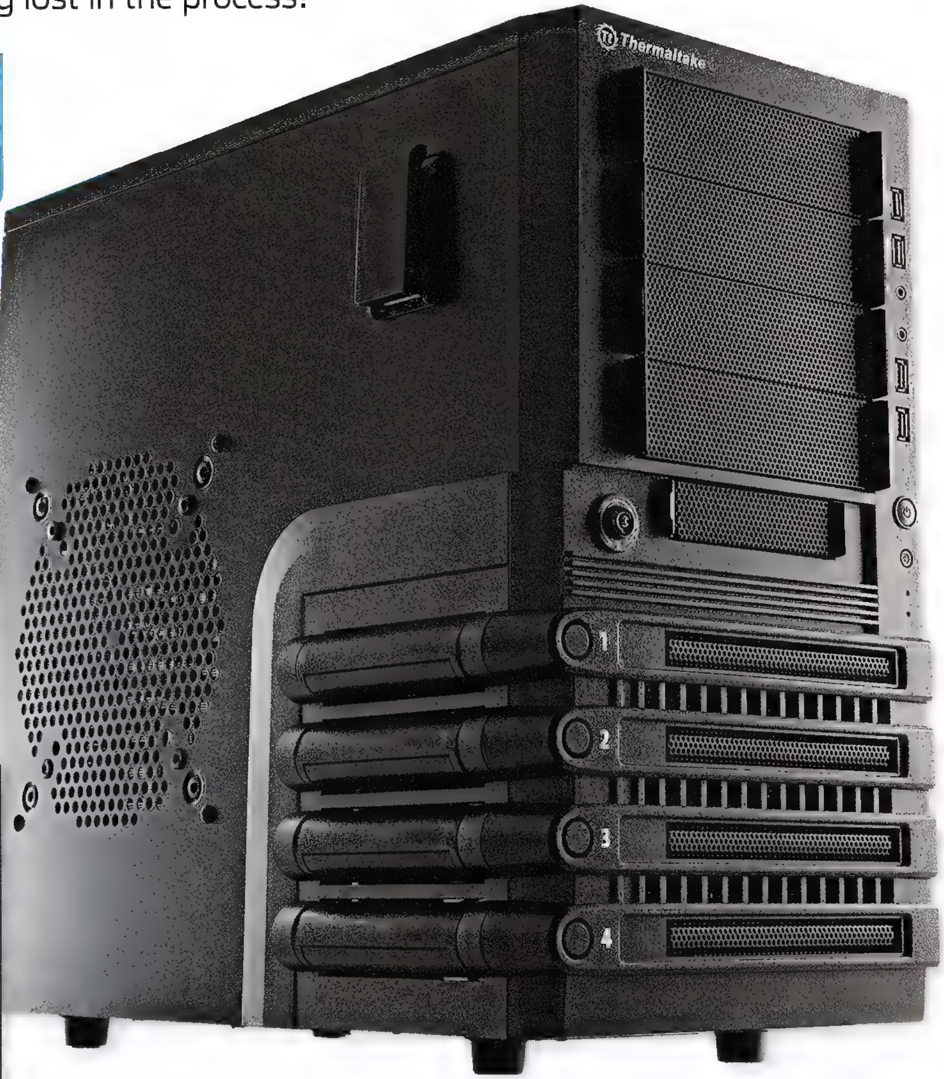
Build
Well put together and packaged for shipping.
94

Overall
Very close to as good as we could build ourselves.
91%

Thermaltake Level 10 GTS

The Level 10 design continues to get boiled down to more mortal levels, but is something being lost in the process?

Street Price $130 **Supplier** Thermaltake
Website www.atomicmpc.com.au/Specs_TT_L10_GTS
Specifications 462 x 233 x 510mm; 6.8kg; 7x expansion slots; 1x 200mm fan (front), 1x 120mm fan (rear); 4x 5.25in drive bays, 1x 3.5in 4x 3.5in (HDD Easy Swap), 1x 2.5in; 2x USB3, 2x USB2, audio ports; MicroATX and ATX.



Few things make the shadowy denizens of the Atomic labs sit back and go "Wow." The original Level 10 case from Thermaltake was such a thing. As the brainchild of an apparent drunken dare between the case maker and car maker BMW, it was epic on just about every conceivable scale. Sure, it may not have looked at ALL like a case, but it did things we didn't even think possible for case design. Every part was thermally isolated, it was rugged as all heck, monolithic in size, and also very expensive. Like, more money than God, expensive.

But Thermaltake's managed to trickle the design fundamentals down into ever-more approachable models, and the GTS is the latest example of this. However, something occurs to us – is there a point to having a Level 10 when it's just a matter of having some ugly curves on the exterior?

More like a level 9...

If you're not familiar with the original Level 10, it's probably worth having a look at (you can see it on our site: **www.atomicmpc.com.au/?146673**). It's anything but conventional, but it deals elegantly with the challenge to thermally isolate each component, and create a striking case. It's elegant in its brutalist approach to computing. The GT (**www.atomicmpc.com.au/?246564**) was more approachable, but still an amazing piece of design. The GTS, well, it's the cheapest Level 10 yet at only $130 at retail, and you can likely find cheaper via StaticICE if you search. But it's not really a great reason to celebrate.

The only major feature that makes it into this case is the aesthetic, and external access to the hot-swappable drive bays. Don't get us wrong – it's great to get a feature like this at a decent price point, and the case is entirely serviceable if what you want is hotswapping – it just feels like a dilution of the Level 10 brand. I think Thermaltake would have been better served by coming up with a new design – and branding – entirely.

On with the show

At first glance, the majority of the Level 10 GTS is about as stock standard as you can imagine. It's a wide mid-tower design, with moulded mesh on the top fascia and mounts for a radiator or two fans. The right-hand panel has a large, embossed section to make room for excess cabling in the interior, and the left-hand panel has another mesh panel for airflow, or another 200mm fan, or a pair of 120mm models. However, the front fascia and lower frontal portion of the side-panel reveal the Level 10 DNA; here you've got a striated set of plastic ribs over a mesh fan intake, leading to the side, where there are four push-button-released HDD caddies. These four curved caddies mirror the same design on all previous Level 10 builds.

These caddies can be locked, and the push-button mechanism disabled; your prOn is safe.

The rear of the case is interesting, too, because of the unique decision to mount the screws (bless!) for securing expansion cards externally. This might sound insecure – and it is, a bit – but there's a metal plate that inhibits easy access to the screws. Still, the screw that secures this second plate is also external, so it's just a mere road bump between you and some arse at a LAN who thinks it'd be funny to unseat your video card.

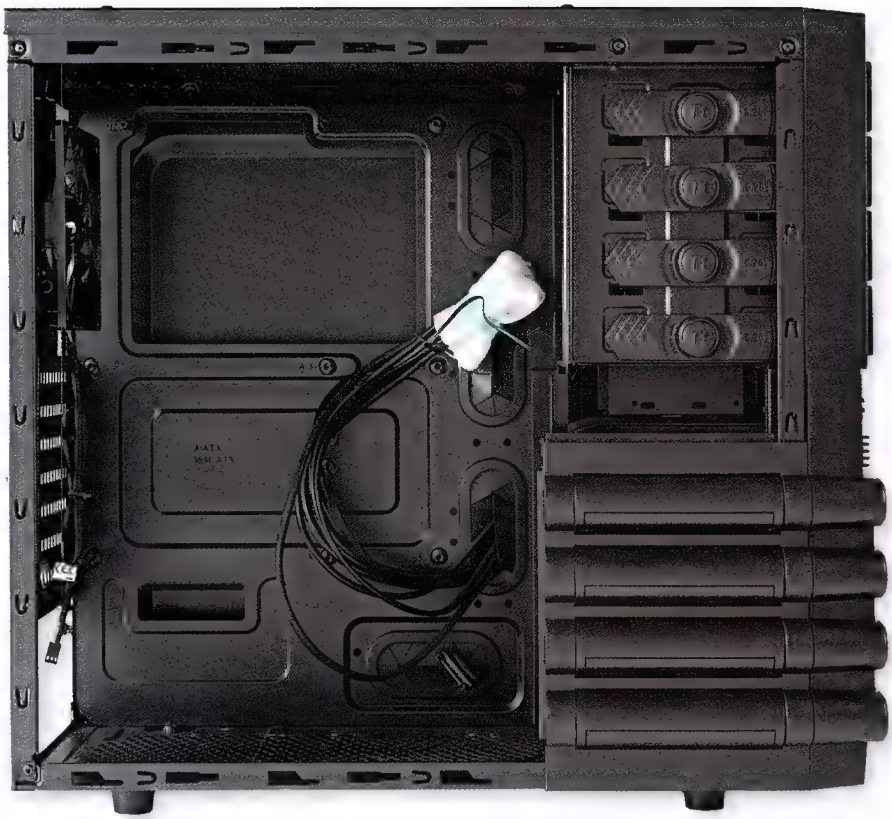
These four curved caddies mirror the design on all previous Level 10 builds... caddies can be locked and disabled; your prOn is safe.

Panel on, panel off

One of things that set other Level 10 builds aside is the whole idea of creating different thermal zones for hardware. The GTS is simply too low-end for that kind of fancy design, however. Instead, you get a pretty standard interior, albeit with lovely rubber grommets in the cable runs, lots of room behind the mobo plate, and even an front panel USB3 connector. It's a little cramped, though – only video cards less than 315mm need apply for residency.

With few exceptions, everything's above board. The drive caddies work as intended, there's mesh to keep too much dust from infesting your case, and it's all nice and black. But not only do you end up feeling that this isn't quite a Level 10 of any kind, but it appears that Thermaltake's QC could use some work. The optical bays are secured by a tool-less clip, but one of ours seemed to have been used as an impromptu skate some time in its past – the underside, and one of the securing posts – was worn down entirely, and rather dirty. Basically, it had been stepped on, and then installed anyway.

For the price, you're getting a lot of great features, so we mustn't be too harsh on Thermaltake; and it's certainly a striking case. However, if – like many – you think the original Level 10 was ugly, this is going to be disappointing to look at. And if you loved the excellent thermal design of previous Level 10s again, with only two fans, you might feel a bit let down. But if you're in that small part of the ever increasingly tiny Venn diagram that is this case's sweetspot – bully for you. **DH**



Build	Solid, though some issues with QC.	73
Value	You get your money's worth.	90
Cooling	A touch underpowered.	79
Features	Very rich – like good chocolate cake!	89
Overall	Bit of a mixed bag from Thermaltake.	79%

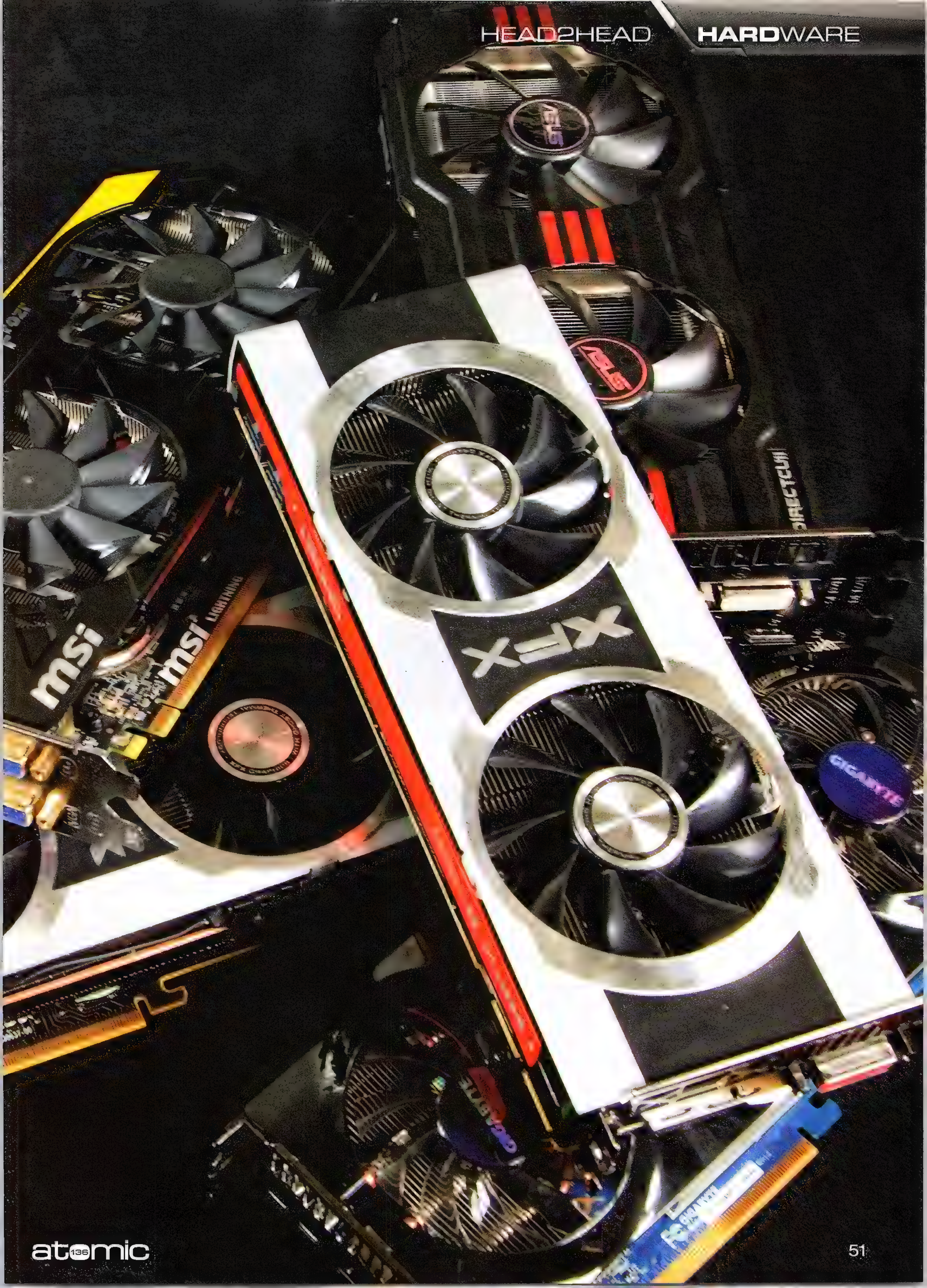
It was the summer of '79

AMD's new range of "Tahiti" GPUs are so damn nice we grabbed eight of them for **Matt Wilson** and **Justin Robinson** to play with. Which cards deserve your hard earned cash?

It's no secret that AMD's Tahiti is a fast core, but which version is the best? We grabbed four different 7970s, along with four of their more affordable brethren, the 7950, and gave them a solid look over. The whole idea of this Head2HEad is to look at the major players on the market right now, dissect what they are offering and give you an informed decision about which card is right for you.

Before we even begin, let's start by saying that most gamers do not even need a video card this powerful. The luxury of owning a 7970 or even 7950 is exactly that. For the price of your average 7970, you could likely buy yourself an Xbox 360 *and* a PS3. For this very reason we would suggest thinking very carefully before you upgrade your video card.

If you're certain your bank can handle the strain, and your PSU is packed with enough of the good stuff, then read on and find the strengths and weaknesses of what's currently available to the AMD enthusiast.


ASUS
DIRECTCUII
msi
msi LIGHTNING
XFX
GIGABYTE

How we tested

When testing video cards it can be quite difficult to include information that is relevant to everyone. Some readers would prefer we stick to workstation tasks as gaming performance is hardly demanding for the new video cards of today, while others want more overclocking and multi-GPU results. We try to balance out our GPU reviews as best we can, providing a range of results from a wide variety of benchmarks.

We overclocked each and every GPU to the limits of its stability on the factory supplied air cooler for those interested in pushing their hardware to the limits, and also recorded temperature and power results for the users who prefer a more balanced PC build.

Our test system is comprised of a GIGABYTE G.1 Assassin 2 motherboard and Intel i7 3960X processor. This combination represents the best current offerings for gamers, and should ensure the benchmark results are never restricted due to CPU, memory or PCI bandwidth restrictions.

All video cards tested in this roundup were using PCI-E Gen 3 ports on the Gigabyte G.1 Assassin 2 motherboard. If you're using a PCI-E Gen 2 port at home your results may differ slightly from our own, but in our in-house testing we only experienced differences of around 1% on the AMD 7970, and even less on lower model cards.

When recording the temperature levels of each card, we were running the stock fan profiles of each individual product, and never tampered with speeds or throttle software. It should also be noted that each card was tested on an open test bench, in an ambient temperature of around 24C, so your results at home may vary inside a PC case, with warmer ambient temperatures.

Load temperatures and power usage was tested while running 3DMark 11, as it should in theory apply 100% load to the CPU and GPU, while some games do not apply full load. We did not use GPU load applications like Furmark as they are notorious for producing extra heat and power draw than is safe for the card, or actually possible in real world situations.

Specifications table

	MSI R7970 Lightning	ASUS HD7970 DCU II TOP	XFX 7970 Double Dissipation	GIGABYTE 7970 Windforce	ASUS 7950 DCU II	GIGABYTE 7950 Windforce	XFX 7950 Double Dissipation	MSI 7950 Twin Frozr
Street Price ($)	$670	$799	$699	$660	$599	$540	$630	TBA
GPU Specs								
Unified Shader Count	2048	2048	2048	2048	1792	1792	1792	1792
GPU Frequency	1070MHz	1000MHz	925MHz	925MHz	900MHz	800MHz	800MHz	800MHz
GPU Overclock	1350MHz (26%)	1280MHz (28%)	1250MHz (35%)	1240MHz (34%)	1180MHz (31%)	1210MHz (51%)	1220MHz (53%)	1250MHz (55%)
Memory Frequency	1400MHz	1400MHz	1375MHz	1375MHz	1250MHz	1250MHz	1250MHz	1250MHz
Effective Frequency	5.6GHz	5.6GHz	5.5GHz	5.5GHz	5GHz	5GHz	5GHz	5GHz
Memory Size	3GB (GDDR5)	3GB (GDDR5)	3GB (GDDR5)	3GB (GDDR5)	3GB (GDDR5)	3GB (GDDR5)	3GB (GDDR5)	3GB (GDDR5)
Card Details								
PCI-E Power connectors	6-pin, 8-pin	6-pin, 8-pin	6-pin, 8-pin	6-pin, 8-pin	dual 6-pin	dual 6-pin	dual 6-pin	dual 6-pin
Ports	2 x DVI, 4 x Mini DisplayPort	2 x DVI, 4 x Standard DisplayPort	1 x DVI, 1 x HDMI, 2 x Mini DisplayPort	1 x DVI, 1 x HDMI, 2 x Mini DisplayPort	1 x DVI, 1 x HDMI, 2 x Mini DisplayPort	1 x DVI, 1 x HDMI, 2 x Mini DisplayPort	1 x DVI, 1 x HDMI, 2 x Mini DisplayPort	1 x DVI, 1 x HDMI, 2 x Mini DisplayPort
Slots, length	Dual, 305mm	Triple, 280mm	Dual, 275mm	Dual, 285mm	Triple, 300mm	Dual, 285mm	Dual, 262mm	Dual, 261mm

MSI R7970 Lightning

When in doubt, slap capacitors on it.

1070 > 1350MHz
26% OC

Street Price $670
Website www.atomicmpc.com.au/H2H_136_R7970_Light

Specifications 1070MHz core; 1400MHz memory (5600MHz effective); 'Tahiti' core; 2048 Unified Shaders (AMD); 3GB GDDR5; 384-bit bus width; dual-slot active cooling; 6-pin+8-pin PCIe connectors.

atomic hot award

All we can say is it's been a long time coming. The Lightning series has always been something we've looked forward to with every flagship card release over the past few years, and this series is no different. The highly overclockable nature of the HD7970 in addition to the advanced power distribution on the Lightning really does make an enormous difference.

Firing up MSi Afterburner, we already had an idea of how well this card would overclock. We were hoping for a 1300MHz clock or above, and we weren't disappointed. A suicide run (very unstable, but still bench-able) of 1390MHz was reached, and 1350MHz was stable enough to complete benchmarks reliably. For those of you who don't care about heat and power draw, the card should remain gaming stable at 1300MHz, far higher than your average 7970 overclock.

In order to provide the GPU with the power required, MSI have included a "GPU Reactor" mounted to the back of the PCB which includes an extra eight capacitors. These wonderful little caps manage to increase the amperage of the card by roughly 88% higher than the reference design, and helps decrease voltage ripple and "noise" by around 13% over the reference PCB design, both critical when tweaking the GPU core voltage past moderate amounts.

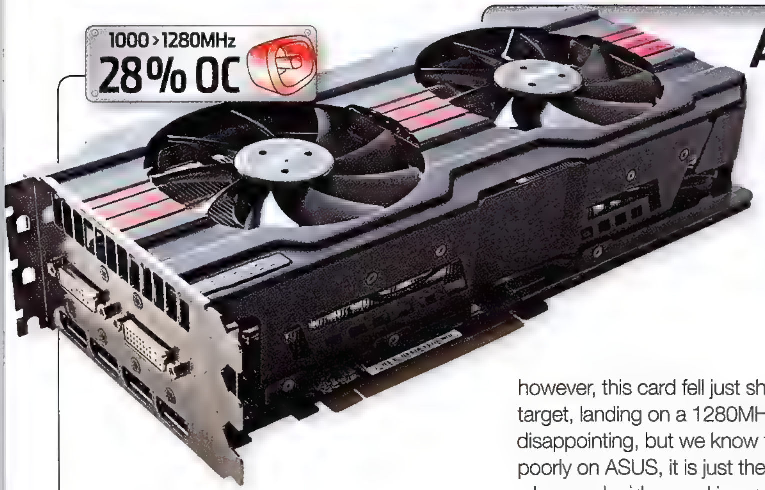
The cooler selected for the task is the new Twin Frozr IV. It's essentially the same as the 3rd generation cooler from what we can see, though the fans do appear to have had some more money spent on them this time. The blades are incredibly solid, they run silently all the way up to ~4,000 RPM and the last, but probably the most important change, is they now have a LED light to make your case look extra pimp. A great enthusiast card.

Overall
MSI provide a well-tweaked card at a competitive price.
90%

ASUS HD7970 DCU II TOP

Three slots for 1.5 times the fun.

1000 > 1280MHz
28% OC



Street Price $799
Website www.atomicmpc.com.au/H2H_136_7970DC2T

Specifications 1000MHz core; 1400MHz memory (5600MHz effective); 'Tahiti' core; 2048 Unified Shaders (AMD); 3GB GDDR5; 384-bit bus width; triple-slot active cooling; 6-pin+8-pin PCIe connectors.

One of the first things people tend to look at when comparing video cards is their factory-applied core clock. And yes, while this card is clocked slower than the MSI Lightning it isn't such a bad deal, in fact, we would say that both cards are extremely comparable at the PCB level, and it's really up to playing the silicone lottery, hitting the jackpot, and finding a highly overclockable GPU.

We have no doubt there will be ASUS DCU II cards out there clocking far better than our sample, hell our reference AMD card was hitting over 1300MHz! Unfortunately for us however, this card fell just short of our 1300MHz target, landing on a 1280MHz overclock. A little disappointing, but we know this doesn't reflect poorly on ASUS, it is just the luck of the draw when each video card is made.

As for the cooling solution on this card, what can we say other than wow. It really does work, arguably not as well as it should with a cooler of this size, but it certainly does keep the card cooler than any other card we tested today. Also, given the large size of the fans, and the thickness of the fins, (allowing them to move more air) they are able to spin at a lower speed, keeping noise to a minimum. For testing we didn't go over 2,000 RPM at any time, using the cards default profile, which goes to show the card can run even cooler, though to be honest you don't even need to tweak the profile behaviour.

The ASUS HD 7970 Direct CU II weighs in at a fairly hefty 1.3kg. The "Direct Copper II" cooler is very similar to that used on previous ASUS cards, and we're happy to see it. After the 7950 DCU II and some extremely shoddy engineering / design decisions we were a little worried. The 7970, however, has put those fears to bed, and we are happy to recommend the DCU II cooler once more.

Overall
Very expensive and large, but well-cooled.
85%

XFX 7970 Double Dissipation

Still the best-looking 7970 card on the market.

Street Price $699
Website www.atomicmpc.com.au/H2H_136_7970DD

Specifications 925MHz core; 1375MHz memory (5500MHz effective); 'Tahiti' core; 2048 Unified Shaders (AMD); 3GB GDDR5; 384-bit bus width; dual-slot active cooling; 6-pin+8-pin PCIe connectors.

925>1250MHz
35% OC

XFX were the first manufacturer to bring out an aftermarket heatsink, but how does this card stand up to the competition months later? MSI, ASUS and GIGABYTE have all released some very nice cooling options to compete, and in this head to head the XFX cooler is unfortunately the weakest (though there isn't much in it).

For anyone who prefers the look of the XFX 7970 over other cards, we would say just go for it. The 1-5 degree difference in temperature isn't significant enough to really worry about. The 7970 is efficient enough to be kept under 80C at all times by two fans that run silently, and if for some reason your fans are spinning a little faster than you deem necessary, customising your fan profile will see you happy once more. Our XFX sample never went above 2,500 RPM, and remained inaudible for the entire benchmark.

The PCB on this card is of reference design, so it's not designed for extreme overclocking (sub zero cooling), though it should still have enough power control to take you to the limits of air overclocking rather easily. Benching was possible on 1270MHz, though the card lost stability rapidly past this point. Not to worry though, as running any 7970 at even 1100Mhz is going to be roughly as fast as a GTX 680 from NVIDIA and the stock 7970 Lightning from MSI. Overclocking may not be completely necessary on these cards, though it can help your cheaper 7970 model perform like one of the best.

We've said it before and we will say it again, this card is one of the most solidly constructed cards on the market. Nothing is fragile or hanging off the PCB, everything is well contained within the polished heat shroud. We would happily suggest this card to anyone who doesn't plan on overclocking to the extreme, or lacks the motherboard space for a 3-slot card.

Overall
A great reference 7970 design.
85%

GIGABYTE 7970 Windforce

It's not overclocked, but it does have a custom cooler!

Street Price $660
Website www.atomicmpc.com.au/H2H_136_R7970_OC

Specifications 925MHz core; 1375MHz memory (5500MHz effective); 'Tahiti' core; 2048 Unified Shaders (AMD); 3GB GDDR5; 384-bit bus width; dual-slot active cooling; 6-pin+8-pin PCIe connectors.

925>1240MHz
34% OC

GIGABYTE were a little slower to market with their Windforce cooled card than usual. We're sure this has something to do with the fact that the PCB we received was still reference design, hinting at custom design problems. Though, XFX managed to get a custom cooler onto the reference PCB before the 7970 had officially launched, so maybe that isn't the reason? Either way, the card is here now, and it's ready for our scrutinising eyes.

As mentioned, this sample is on reference PCB, and it also sports a reference clock of 925MHz. Please be aware however, that "overclocked" editions of this card are also available, and will ship (to the best of our knowledge) at a 1GHz core clock. Aside from the factory set clocks, however, the two cards are completely identical.

GIGABYTE will launch their custom PCB card soon no doubt, and it is expected to be dubbed "Super Overclock" like the previous generations. The core clock is not known, but given that the reference card is 925MHz, and their OC card is 1000MHz, it would only make sense for the SOC to be in the range of 1,100MHz.

Anyway, back onto this sample, we managed a core clock of 1240MHz in the end, so somewhere towards the lower end of the spectrum, but this is not too surprising. It seems the range for a reference PCB card is anywhere from 1200-1350MHz with a huge amount of luck involved to snag yourself a card that clocks much above 1300MHz.

The cooler is quiet, just like every previous Windforce-cooled card, and given the thin blades, you get absolutely no "swooshing" noise generated by airflow. The cooler can also be removed in favour of a water cooler given the reference design, though please do check your PCB is revision 1.0 before purchasing, as it is open to change in the future.

Overall
A great reference design with a quiet cooler.
89%

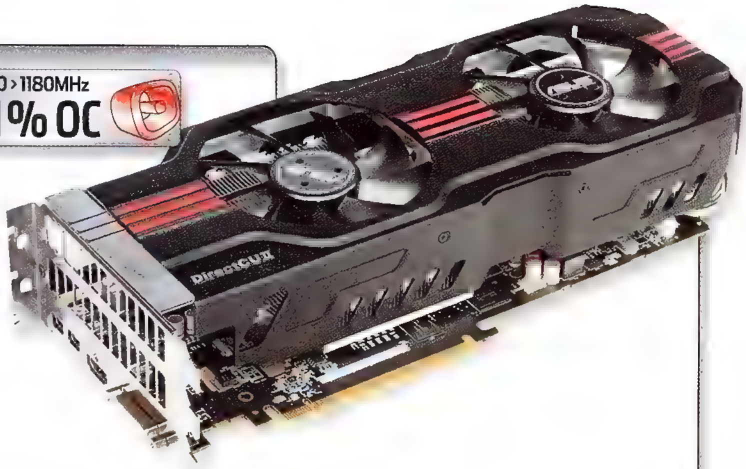
ASUS 7950 DCU II

Still big, but more expensive.

900 > 1180MHz
31% OC

Street Price $599
Website www.atomicmpc.com.au/H2H_136_7950DC2T

Specifications 900MHz core; 1250MHz memory (5000MHz effective); 'Tahiti Pro' core; 1792 unified shaders; 3GB GDDR5; 384-bit bus width; triple slot active cooling; dual 6-pin PCIe power connectors



The ASUS 7950 DCU II is one of the most disappointing cards ASUS have released in the past few years. It simply screams laziness, and is evident in nearly every aspect of the card's engineering. The PCB is reference design (though it has higher quality components on board), the cooler seems to have just been whatever they had left over from 6970 stock, sloppily modified and balanced 2CM too far back on the card with a cheap-looking aluminium stand-off.

When you apply even a very small amount of pressure to different parts of the card the entire cooler shifts, which isn't surprising given the only mounting points to the PCB are the four screw holes around the GPU socket. The entire shroud of the card is a joke; it doesn't even direct airflow as it has gaping holes on either side. If anything this will just hold hot air around the card for longer, before dumping it in your case. At least MSI and GIGABYTE make the cooler dual-slot, not triple.

Cooler and design rant aside, the card isn't anything special. You're playing the silicone lottery like any reference card and in this case we didn't come out on top. We managed an 1180MHz overclock, which is rather good for a 7950, though we experienced better results on other cards.

Fan noise is more than acceptable, though that hardly makes up for the rest of the card design. You know, we wouldn't care as much about all of these flaws if ASUS just admitted the card was a rush job. But instead, ASUS charge $50 more than any other card on the market. In our opinion you're far better of picking yourself up a nice MSI Twin Frozr or Gigabyte Windforce.

Overall
A poor choice in many ways.
68%

GIGABYTE 7950 Windforce

The younger brother of the 7970.

800 > 1210MHz
51% OC

Street Price $540
Website www.atomicmpc.com.au/H2H_136_R7950WF_OC

Specifications 800MHz core; 1250MHz memory (5000MHz effective); 'Tahiti Pro' core; 1792 unified shaders; 3GB GDDR5; 384-bit bus width; triple slot active cooling; dual 6-pin PCIe power connectors

GIGABYTE have released two versions of the 7950 to market, both with the Windforce cooler, the "vanilla" version of which we are reviewing today. There is also an "overclock" edition, which sports a more potent 900MHz core clock. For the average Atomican however, changing the slightly cheaper 800MHz model into a 900MHz card should be as simple as a few mouse clicks.

When pushing this card to its limits, we came awfully close to a new 7950 record for our labs. 1,210MHz was our final clock, falling only 10MHz short of the XFX 7950. It's safe to say that both cards are identical, because in fact... they are. Both the XFX 7950 and the Gigabyte 7950 tested today are built on reference design PCB, so again (like with most cards) it's just luck of the draw how overclockable your GPU is.

The Windforce cooler looks to be the same as the 7970 design, measuring in at the same length, with the same amount of cooling fins. This allows the card to stay a mighty respectable 71C under full load, matching the performance of the ASUS 7950 DCU II. Not bad considering it should cost you $60 less than the ASUS offering.

Again, given this card can accept full block water cooling please check that the card you buy is PCB revision 1.0, as this is likely to change to a non-reference design at some stage in the future. It is not quite certain if GIGABYTE will release a "SOC" version if this card, or if they will simply reserve that honour for the 7970, though we certainly hope to see some higher offering from Gigabyte, as the 7950 core has much more to give than its reference core clock.

Overall
A great reference version of the 7950.
79%

XFX 7950 Double Dissipation

The strangest pricing we've seen in a while.

Street Price $630
Website www.atomicmpc.com.au/H2H_136_7950DD

Specifications 800MHz core; 1250MHz memory (5000MHz effective); 'Tahiti Pro' core; 1792 unified shaders; 3GB GDDR5; 384-bit bus width; triple slot active cooling; dual 6-pin PCIe power connectors

800 › 1220MHz
53% OC

XFX aren't the ones to change a winning formula, and we can't say we blame them. A couple of weeks after the 7970 launch, we received the 7950 Dual Dissipation. It looks identical to the 7970 in almost every way, and it could even be said that the cooler used is actually the same one; especially given that is has about 1.5mm of overhang off the back of the card and the 7950 sits around 2mm shorter than the 7970.

There is no doubt in our minds that this cooler is one of the best – if not the best – cooler that XFX have produced on any card. It looks great, performs well, and most importantly, it can be manufactured at a more than reasonable price.

Overclocking the XFX 7950, we soon reached a maximum stable clock of 1220MHz. Not too shabby at all, and a clock that will apply pressure to even the GTX 680 in the vast majority of benchmarks. Of course you could simply argue the GTX 680 could also be overclocked for greater performance, which is true, though given our experience with the card, the ~150MHz overlock available really doesn't improve performance as drastically as overclocking on the 7950 or 7970.

Fan noise is fine on this card, never causing any unnecessary noise, and always keeping the card below 75C while gaming. Sure, it's no DCU II, but it's close enough. Stupidly, the card is retailing at $630, which is $30 more than the DCU II. Who's to blame for going with a high price considering the economical cooler design? It appears to be working as intended, offering a more than fair product, though you will pay far too much for it.

Overall
A great card priced well out of reach.
69%

MSI 7950 Twin Frozr

The highest-clocking 7950 card to hit our Labs!

800 › 1240MHz
55% OC

Street Price $TBA
Website www.atomicmpc.com.au/H2H_136_R7950_Frozr

Specifications 800MHz core; 1250MHz memory (5000MHz effective); 'Tahiti Pro' core; 1792 unified shaders; 3GB GDDR5; 384-bit bus width; triple slot active cooling; dual 6-pin PCIe power connectors

The Twin Frozr III cooler is the latest and greatest from MSI. We're not sure on exactly what has changed, as the number seems to go up every GPU generation and the cooler seems to only change colour or have some LED lights glued on. As far as we can tell, the cooler is largely the same as the Frozr III and the performance results would also indicate the assumption fairly true.

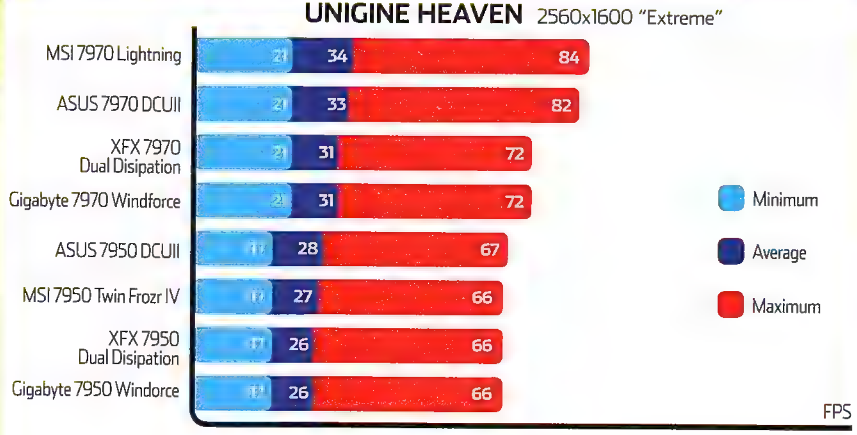
Fan noise is far more than acceptable, along with actual cooling performance. The design is aesthetically pleasing, and also rather compact, keeping plenty of room free around the card and leaving no messy cables or other limbs exposed.

Overclocking was relatively successful, reaching a core clock of 1240MHz, our new top clock for the 7950. Of course, this can't all be put down to brilliant PCB design on the part of MSI, though we can't deny it likely plays a part in the end result.

The fans never became audible, even when overclocking and leaving the default profiles active. Which leads us to believe this cooler has plenty more to give if you plan on tweaking your settings to suit your environment and PC tower.

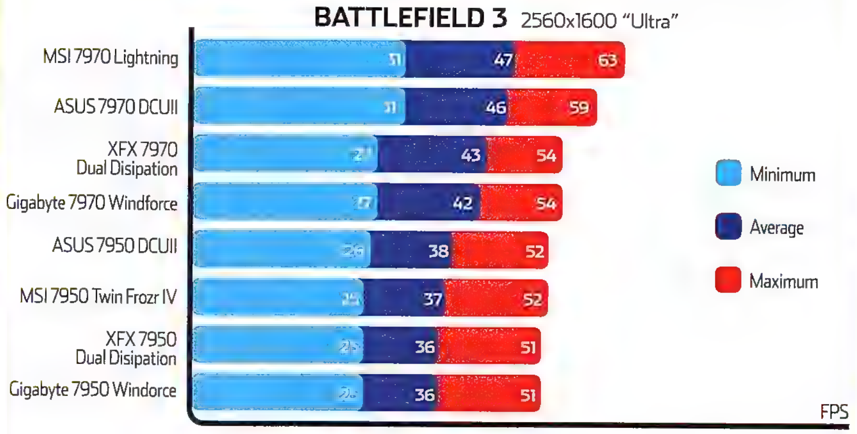
The performance level on all of these cards is excellent and more than enough for the enthusiast gamer with a monitor up-to 1920x1200 and even 2560x1600. This is a product we can very much recommend, with good performance, good looks with a nearly inaudible product. Pricing remains a little high in Australia for other MSI 7950 cards at the moment, but that aside the MSI R7950 TwinFrozr III definitely managed to impress.

Overall
A decent 7950 with a good cooler that overclocks very well.
84%

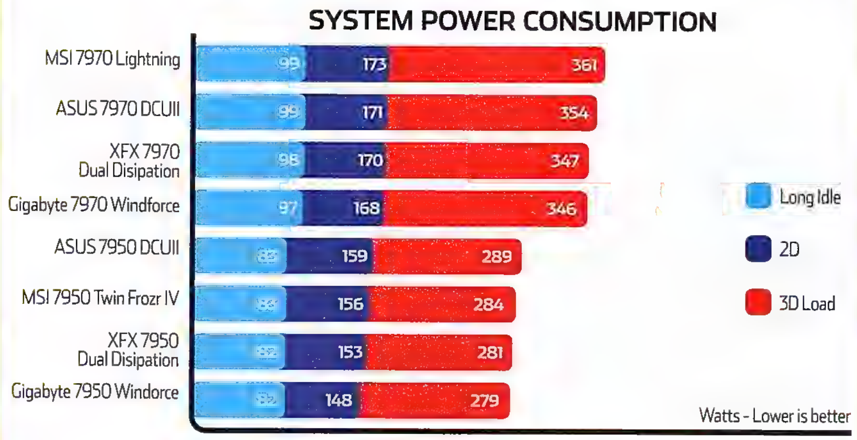


UNIGINE HEAVEN 2560x1600 "Extreme"

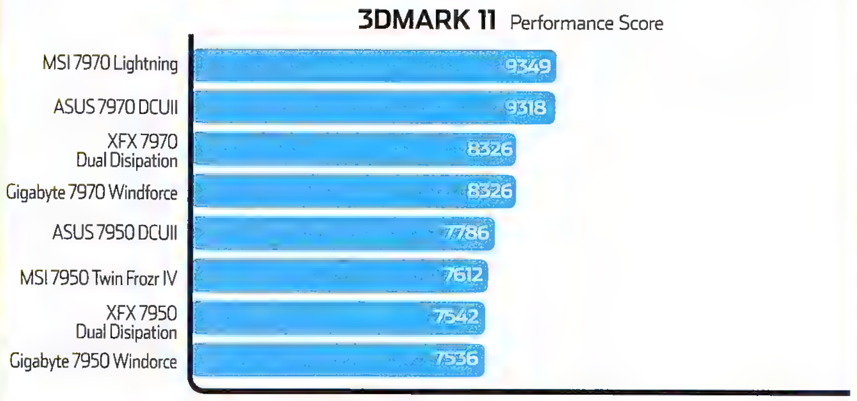
MSI 7970 Lightning 21 34 84
ASUS 7970 DCUII 21 33 82
XFX 7970 Dual Dissipation 21 31 72
Gigabyte 7970 Windforce 21 31 72
ASUS 7950 DCUII 17 28 67
MSI 7950 Twin Frozr IV 17 27 66
XFX 7950 Dual Dissipation 17 26 66
Gigabyte 7950 Windforce 17 26 66
Minimum
Average
Maximum
FPS



BATTLEFIELD 3 2560x1600 "Ultra"



SYSTEM POWER CONSUMPTION



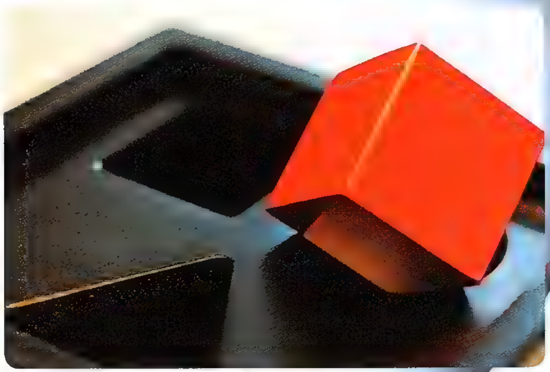
3DMARK 11 Performance Score

All Games Benchmarked with FRAPS

KITLOG

These are four of our basic systems, with something for every taste. **The Game Box** is put together with money-saving in mind, but also an eye to getting as much bang for buck. Our build may be a little more expensive than what you could technically get away with, but for that extra few hundred you're also getting cutting edge performance and one of the most overclockable chips you can get today.

The process of putting a PC together is relatively simple, and almost anyone can do it. The hard part, as many will ultimately discover through trial and error, is getting a good rig at the end of it. Builds featured here are a great starting point for any user; but we always recommend customising for your particular needs. There's no point cramming a fast GPU in if you never play games!

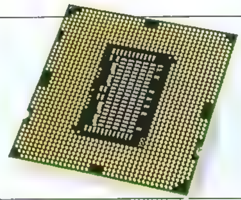


The Perfect PC, on the other hand, is the system everyone aspires to, with nothing but the best parts – without going crazy, though. It's a collection of all the greatest hardware that we'd pick without a budget, sure to impress with performance and sheer style.

Oh, and if you're wondering what the Ref IDs are, that's the ID of that article on our website. Just enter it like this – **www.atomicmpc.com.au/?NUMBER** – and you'll go straight to that review.

THE GAME BOX

CPU



Intel Core i5 2500-K

PRICE $220

Sandy Bridge's combination of cost and overlocking prowess is awesome.

Issue 122, Page 36

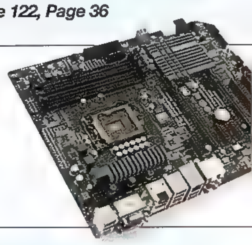
MOTHERBOARD

Gigabyte Z68X-UD3H-B3

PRICE $170

Affordable gaming performance and features.

Ref ID: 263631



MEMORY

G.Skill Ripjaws F3-12800CL9D-8GBXL

PRICE $55

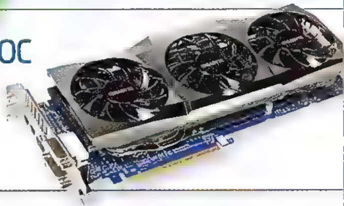
Great value, decent perfomance, and some flexibility.

VIDEO CARD

GIGABYTE HD6870 OC

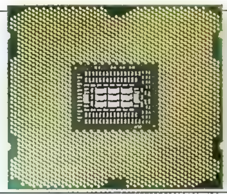
PRICE $205

The HD7870 is just around the corner, 6870s are now on sale.



THE PERFECT PC

CPU



Intel Core i7 3930K

PRICE $640

Six cores of Sandy Bridge-E loving. Overclock for justice!

Issue 132, Page 32

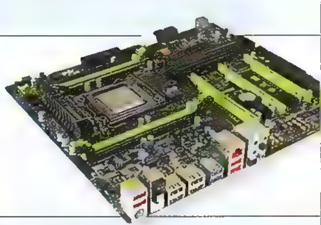
MOTHERBOARD

Gigabyte G1.Assassin 2

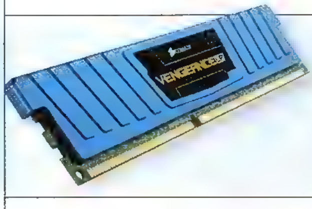
PRICE $450

It's about as super-premium as you could get, or want.

Ref ID: 281856



MEMORY



Corsair Vengeance Low Pro CML16GX3M4A1600C9B

PRICE $119

16GB of fast memory. Virtualise everything!

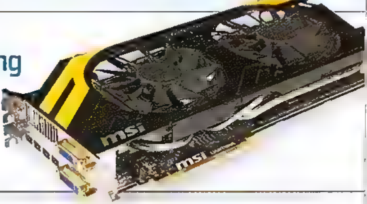
VIDEO CARD

MSI R7970 Lightning

PRICE $670

Great value, overclocks extremely well, super fast.

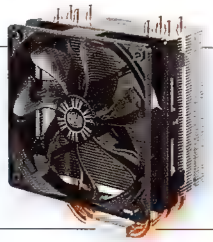
Issue 136, Page 53



SUBTOTAL: $1418

RIG ONLY: $959

COOLER



Coolermaster Hyper 212 Evo

PRICE $40

Nice cooling for a very affordable price.

CASE

Bitfenix Shinobi

PRICE $79

Worth it for the price alone, and sexy to boot.

Ref ID: 260177

SYSTEM DRIVES

2TB HDD

PRICE $90

Two thousand gigabyte storage drive on the cheap.

Pioneer DVR-219L

PRICE $35

Discs. You needs 'em.

KEYBOARD

Razer Arctosa

PRICE $50

A cool-looking keyboard that'll serve you very well.

Ref ID: 149483

DISPLAY

Samsung S24A450BW

PRICE $260

24 inches of LED backlit, 16:10 LCD screen. Sweet.

MOUSE

Corsair Vengeance M60

PRICE $69

Exceptional mousing value.

Issue 134, Page 49

AUDIO

Plantronics Gamecom 777

PRICE $80

Solid set of cans with great audio.

Issue 101, Page 41

Onboard Realtek ALC889A

A decent chip that does the job.

POWER SUPPLY

Silverstone Strider 500W

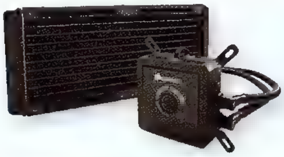
PRICE $65

A solid PSU, capable of powering much more.

SUBTOTAL: $5059

RIG ONLY: $3686

COOLER



Corsair H100 Water Cooler

PRICE $159

Fits perfectly in th Cosmos S II, mounting directly on the roof.

CASE

Cooler Master Cosmos II

PRICE $399

The only case you'll ever need. Premium luxurious bliss.

Ref ID: 290959

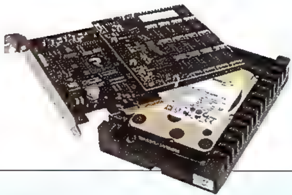
SYSTEM DRIVES

OCZ REvo Drive 3 x2 & WD 600GB VelociRaptor

PRICE $699 + $230

Superfast SSD with zippy storage.

WD: Ref ID: 220323



KEYBOARD

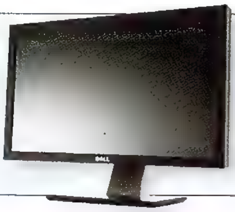
Razer BlackWidow Ultimate

PRICE $160

The new benchmark in gaming quality.

Ref ID: 251095

DISPLAY

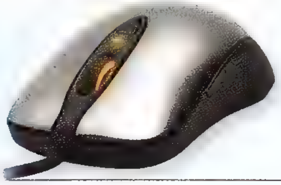


Dell U2711

PRICE $899

One of the best 27" monitors on the market. On sale regularly.

MOUSE



SteelSeries Sensei

PRICE $115

The best-performing mouse we've used to date!

Ref ID: 276668

AUDIO

Shure SRH-840

PRICE $199

The best value closed-ear studio headphones around

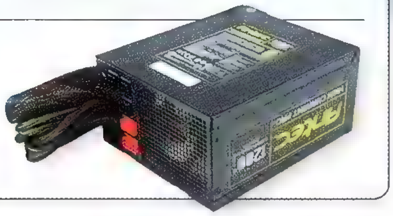
POWER SUPPLY

Antec HCP 1200W

PRICE $320

Plug in a graphics card. Or four. The HCP won't care.

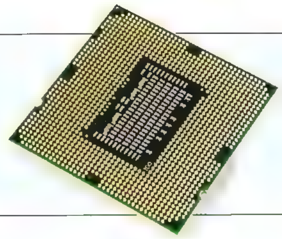
Ref ID: 272588



The **LAN Rig**, the ultimate in portable gaming power – go anywhere, frag anyone. No longer will you be tied to a desk or forced to awkwardly manhandle your full-sized rig, helped by a convenient handle and beefy tech. Perfect for wowing people at LANs, the tech inside is fast enough to run any game, and boasts enough speed to keep your game running at full clip even if other programs intrude in the background. After all, no-one wants to miss a headshot.

THE LAN RIG

CPU



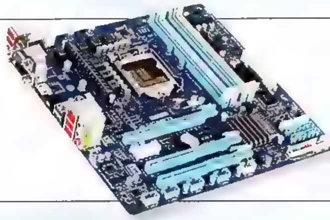
Intel Core i5 2310
PRICE $190

Intel's most affordable quad-core, overclocking limited.

MOTHERBOARD

GIGABYTE Z68MA-D2H-B3
PRICE $150

A mATX board with everything you need.



MEMORY

G.Skill Ripjaws F3-12800CL9D-8GBXL
PRICE $55

Great value, decent performance, and some flexibility.

VIDEO CARD

GIGABYTE HD6870 OC
PRICE $205

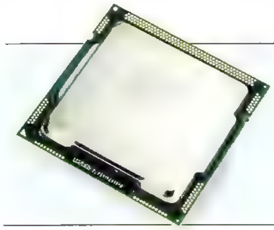
Keeping your LAN box cool and powerful.

There are times when a soundcard can't cut it for your audio desires, where your 600ohm headphones feel underpowered and you need more OOMPH. Thankfully there's a market to cater for you, and multiple Digital-Analogue-Converter/Amplifier hybrids are on the market, such as the ASUS Essence One or Matrix Mini-I. They give much better audio quality, and the punch needed to enjoy music to its fullest. Only serious enthusiasts need apply.

Finally, for the more entertainment-minded – and really, that's all of us – there's **The Mini**, ready to play movies and music quietly and efficiently. The basic guts are fast enough for general tasks, and the IGP can handle High-Definition content. You can also choose from three entirely optional upgrades to suit your needs best: a graphics card for WoW, TV tuner to catch the game, or a Wireless card to sync without cables. The perfect energy-conscious build.

THE MINI

CPU



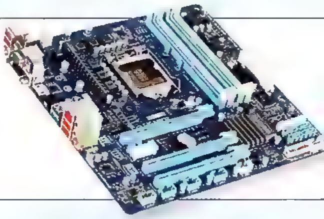
Intel Core i3 2120T
PRICE $150

Super low-heat dual-core processor with IGP.

MOTHERBOARD

GIGABYTE Z68MA-D2H-B3
PRICE $150

A mATX board with plenty of storage options.



MEMORY

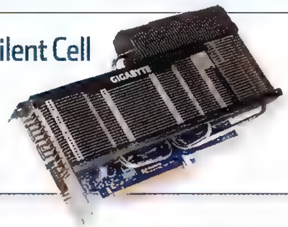
Corsair XMS3 CMX4GX3M2A1600C9
PRICE $35

4GB of fast memory is plenty for running multiple HTPC media streaming apps.

VIDEO CARD

Gigabyte HD6770 1GB Silent Cell
PRICE $145

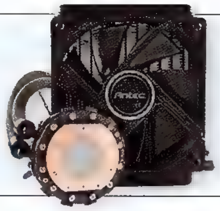
Enough to play games on, and adds outputs without extra noise.



SUBTOTAL: $1319

RIG ONLY: $960

COOLER



Antec Kuhler 620

PRICE $90

Show off your 1337 rig with watercooling. Aw yeah.

CASE

InWin Dragon Slayer

PRICE $80

Tiny case with great potential, it's got it where it counts.

SYSTEM DRIVES

2TB HDD

PRICE $90

Two thousand gigabyte storage drive on the cheap.

Pioneer DVR-219L

PRICE $35

Discs. You needs 'em.

KEYBOARD

Razer Arctosa

PRICE $50

A cool-looking keyboard that'll serve you very well.

Ref ID: 149483

DISPLAY

Samsung S23B300B

PRICE $160

23 inches of value-packed screen, great buy.

MOUSE

Corsair Vengeance M60

PRICE $69

Exceptional mousing value.

Issue 134, Page 49

AUDIO

Plantronics Gamecom 777

PRICE $80

Solid set of cans with great audio.

Issue 101, Page 41

Onboard Realtek ALC889A

A decent chip that does the job.

POWER SUPPLY

Silverstone Strider 500W

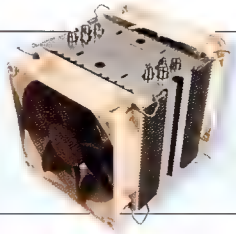
PRICE $65

A solid PSU, capable of powering much more.

SUBTOTAL: $1535

RIG (NO OPTIONS): $1025

COOLER



Noctua NH-U9B SE2

PRICE $65

Plenty of cooling, and quietness to boot.

CASE

Silverstone Fortress FT03

PRICE $190

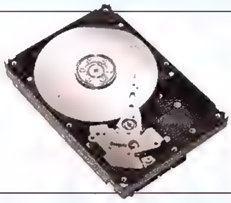
The best HTPC case we've seen yet, with space for plenty o' bits.

SYSTEM DRIVE

2TB HDD

PRICE $90

Buy three of these for super-crazy storage capacity.

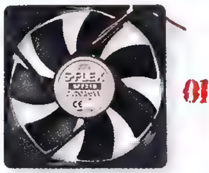


COOLING

Scythe SFF21D

PRICE $30 x 3

Replace the stock fans and hear the computer no more.



OPTIONAL

OPTICAL

OPTIONAL

Silverstone SOD02B

PRICE $80

Slot-loading DVD drive for movies, installs or backups.

KEYBOARD

Logitech diNovo Edge

PRICE $240

Wireless board with a trackpad for mousing.

TV TUNER

Leadtek Winfast PxDVR3200 H

PRICE $100

Get TV in your PC. H.264 recording ftw!

OR

OPTIONAL

WIRELESS

ASUS PCE-N13

PRICE $45

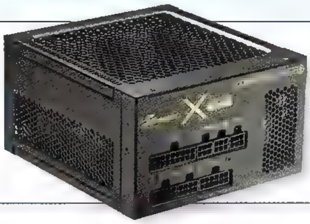
Zippy 802.11N for wireless HD video streaming.

POWER SUPPLY

Seasonic X-460 Fanless

PRICE $200

"Look, ma, no fans!" -Anonymous, 2011



COOLER MASTER 20th ANNIVERSARY 1992 - 2012

Cooler Master
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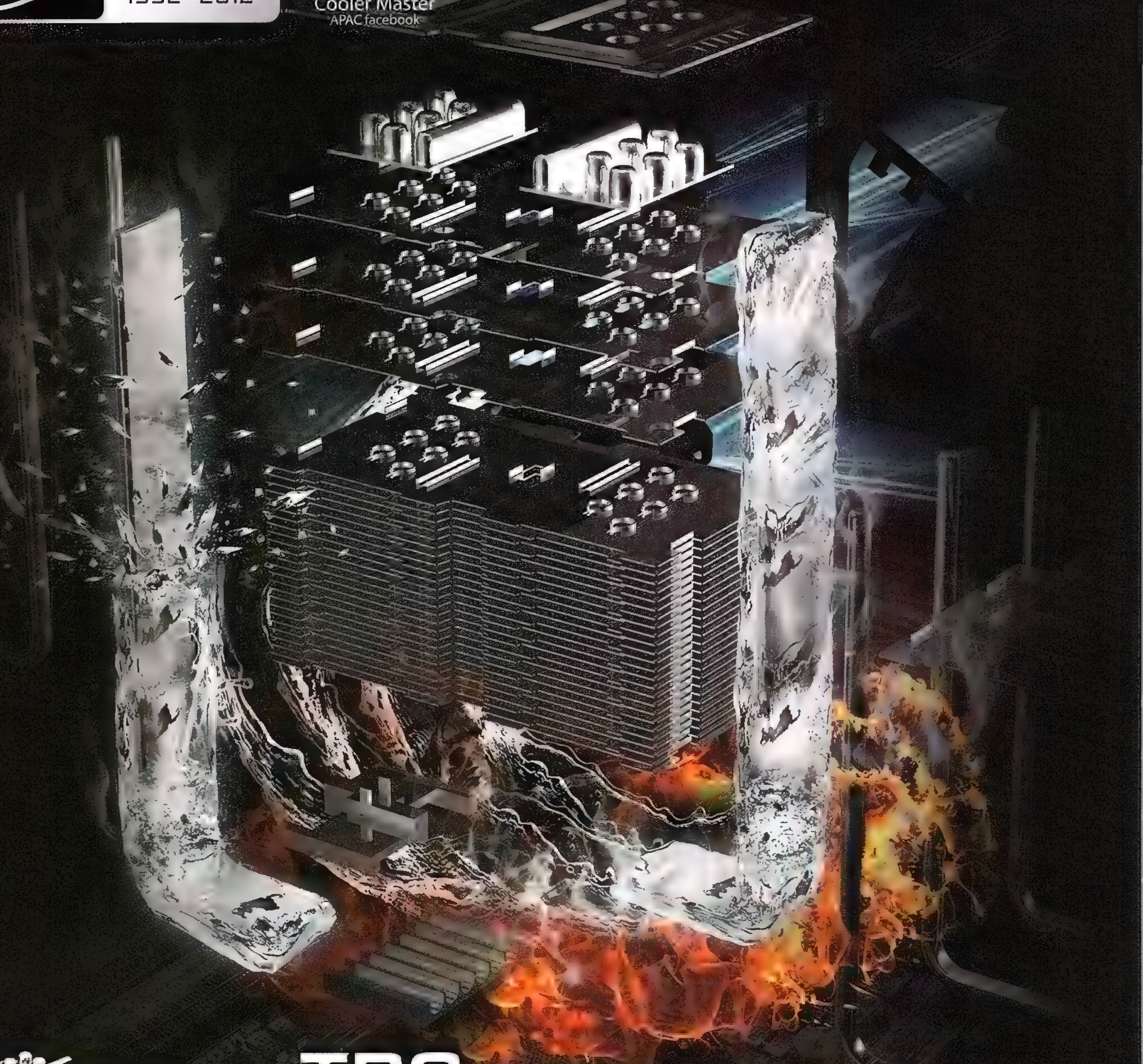
THE FIRST EVER CPU HEATSINK TO
UTILIZE VERTICAL VAPOR CHAMBER



A new height of air cooling

TPC
812

The TPC 812 with Vertical Vapor Chambers is finally available. Your overclocking speeds are going to be massively improved. Vertical Vapor Chambers quickly absorbs heat generated by your CPU and moves it up through the CPU Cooler to the fins. Here, Air resistance is cut in half and fin contact area is 3 times larger compared to conventional heatpipe heatsinks. As a result the TPC 812 can handle massive heat loads generated by overclocked multi core CPUs like never before. An improved fan mounting system makes the TPC812 quick and easy to install.

3X Fin Contact Area

1/2 Air Resistance

Super Fast Heat Transfer

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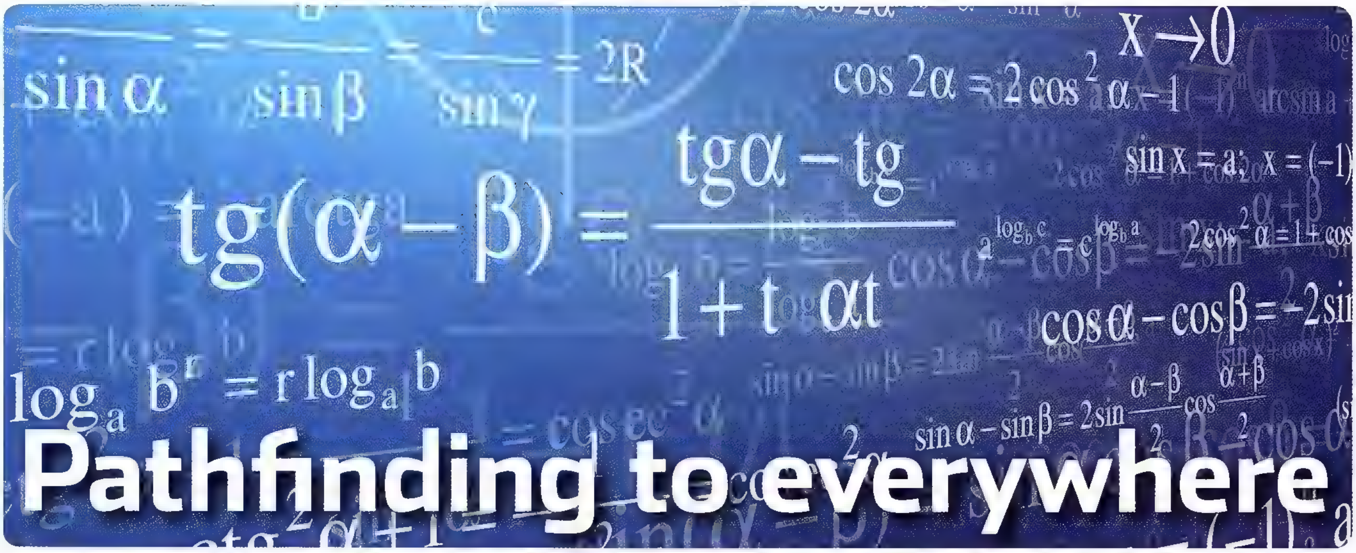
	PC Case Gear	03 9551 0889	pccasegear.com.au
NSW	PCDIY	02 9648 1001	pcdiy.com.au
	ARC Computer	02 9748 8322	arc.com.au
	Aus PC Market	02 9646 8088	auspcmarket.com.au
	Capitol Computer	02 9281 8890	capitolcomputer.com.au
	Tech Buy	02 9648 1818	techbuy.com.au
	MSY Technology	02 9648 4116	msy.com.au
SA	PCDIY	08 8410 0446	adrenalin.net.au
	Allneeds Computers	08 8221 8661	allneeds.com.au
QLD	Computer Alliance	07 3421 3200	computeralliance.com.a
	Game Dude Computers	07 3387 1500	gamedude.com.au
	MSY Technology	07 3217 9070	msy.com.au
	Umart Online	07 3369 3928	umart.com.au
WA	Austin Computers	08 9201 2788	austin.net.au/index.asp
	MSY Technology	08 9344 1002	msy.com.au
	Netplus Micro Computers	08 9242 7288	netplus.com.au



Pathfinding to everywhere

Navigating in real or virtual worlds is hard. **Dan Rutter** explains.

The glory of mathematics is that it's completely abstract, by definition, but can also apply to a very large number of real-world situations. The classic objection to learning algebra – "when am I *ever* going to use this?" – can have some surprising answers.

Take pathfinding, for instance.

In computer games, pathfinding is what lets an entity in a game – a unit in an RTS, a monster in an RPG – get from one spot A to spot B without being guided through every navigational choice by the player or coder.

Pathfinding in 3D games frequently equates to cheating. Since it's easy to break down most 3D game maps into relatively few paths between important locations, invisible pathfinding rails can be baked into each map.

There can be many units going from A to B; they're not allowed to walk through each other.

RTS games have to be smarter about pathfinding, because there can be large numbers of units trying to get from A to B, and they're probably not allowed to walk through each other. Getting each unit to dynamically figure out where bottlenecks are and whether they should wait their turn to go through or take a longer route – which could easily be useless, suicidal or both – creates a combinatorial explosion of pathing decisions which can easily take up way too much CPU power, even on a cutting-edge PC.

Pathing techniques that can get a bunch of robot warriors through a narrow mountain pass can be used for other things, as well. (Heck, *Frozen Synapse* even *looks* like a computational geometry simulation.)

An unexciting but very important application for pathfinding algorithms is network routing, on anything from a home LAN (where routing is generally trivially simple) to the whole Internet (where it really, really isn't).

It's normal for there to be several routing steps just between you and the ISP servers. The billions of nodes on the entire Internet connect in ever-shifting patterns, as particular routes get clogged or broken.

Road navigation is a rather less complex problem, because roads and towns stay pretty much static. But it does have some of the real-world problems and complications of Internet routing, and can have more disastrous results for end-users who find themselves directed up a dirt road and over a cliff that their GPS didn't know about.

A lot of the extra complexity comes from "flow networks", in which connections between nodes have limitations in the amount and direction of traffic they can handle. Flow-network pathing can be used in a game to let units plan to avoid traffic jams, or by municipal planners to lay out traffic lights and roadworks to minimise *real* traffic jams, or for lots of other applications. Water and sewage transport, electricity grids, meteorology, biology, zoology...

Surprisingly, we've actually been computer-simulating very complex systems, like the forces and control inputs affecting a car, or the behaviour of national economies, since well before the invention of the transistor. The trick is to use an *analogue* computer. If you're modelling something that behaves like a fluid flowing through tubes and valves and pumps and reservoirs, just build that plumbing, put some water in it, and start computing!

The most famous "water computers" were the Monetary National Income Analogue Computers (MONIACs), invented in 1949. They were meant to be educational simulators, but turned out to be at least as good at predictions as human economists; though that's not saying much. More practically, the maze of hydraulic hardware in an automatic gearbox is, in essence, a single-program analogue computer.

Sometimes the theory of finding paths through graphs of nodes applies obviously, as in network routing and GPS navigation. But it's lurking in loads of other areas. Shifts in animal populations. What people buy, and what sellers charge. And, yes, the sometimes-sensible, sometimes-idiotic movements of Mammoth tanks and Belltower mercenaries.

So the Algebra Objection can be answered: "Is ten times a day enough for you?"

Dan always fully expands his burgers before eating.
dan@atomicmpc.com.au

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TUTORIAL

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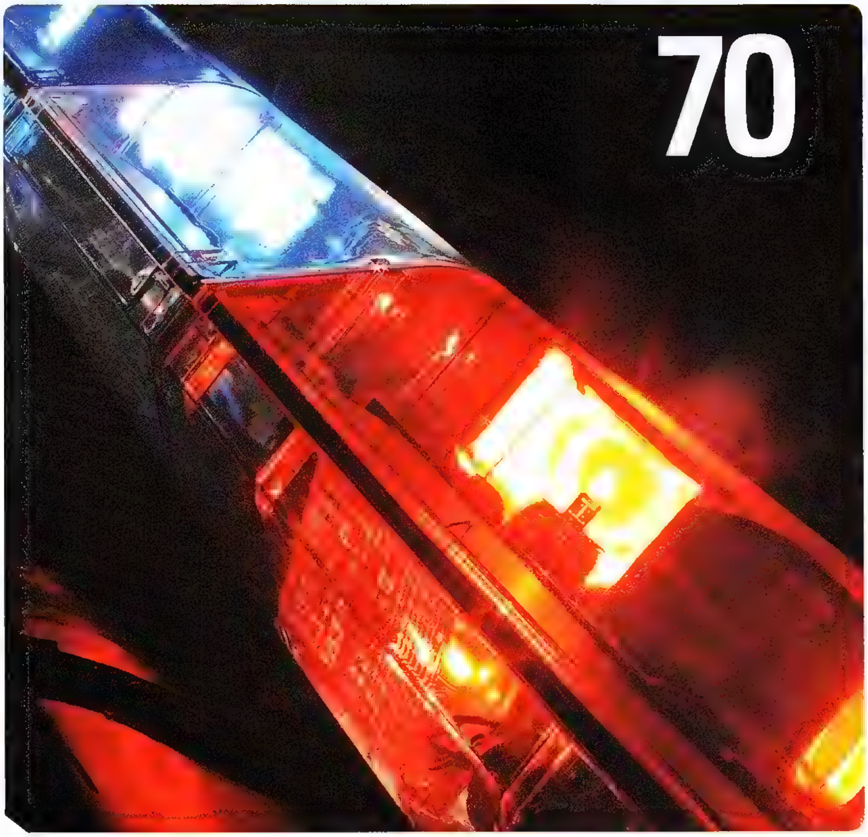

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ATOMIC.EDU 67
Chris Taylor discusses work in the Police Force, and how best to apply your skills.

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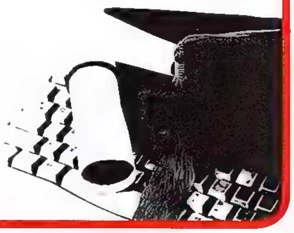


Consider the Police Force

Christopher Taylor thinks there's merit to employment as protector of the peace.

Despite the fact this column is entitled '.edu', we occasionally cover career paths – such as this one – that don't require much more, at least not in terms of academic qualifications, than you passing Year 12. This month we're looking at careers in law enforcement – both at a state level and a federal level, in organisations such as Customs, the Federal Police and the Crime Commission. Although there are graduate-entry positions in some law enforcement agencies and a higher qualification (be it from TAFE, university or somewhere else) can help you get a job or move up the food chain, for the most part you don't need a Bachelor's degree to become a police officer.

True blue

A career in the police force is, to use a cliché, not everyone's idea of a good time. There are some people who might like the idea but are, for a myriad of reasons, physically and/or psychologically unsuited to the job. It can be dangerous and stressful and everything else. The entry-level pay for most law enforcement agencies (at least, on a state level) is okay but not exceptional: to be honest, if this writer was going to take on a job where he could maybe be assaulted by a steak knife-wielding bogan during a domestic dispute, he'd maybe wanting to be taking home a little more each week. If you decide to look into a career in federal-level law enforcement, whether it's with the Australian Federal Police or the Crime Commission, the pay can be a bit (or even a lot) better at an entry level, but it usually involves uprooting your life and moving to the nation's capital. Flexibility is a must when applying to work in law enforcement. The federal agencies will probably expect you to move to Canberra – at the very least for your training, but possibly also for the actual work. The state and territory-level police forces may or may not listen to you when you say you'd prefer to work close to home. They may expect that you move somewhere far away.

Unless you're looking at a desk job with, say, ASIC or the Crime Commission or perhaps Customs, there will be some sort of physical fitness requirements – though you don't need to be a body-building gym fiend from the outset (and you are given training), the police force want you arriving in the sort of state they can actually work with, much the same as the defence force will expect a certain level of capability. If you got puffed walking out to the mail box to fetch this magazine, then you might want to watch the home shopping channel late at night to see if you can get a good deal on a foldaway combo treadmill/rowing machine. As much as ASIC and its ilk don't have fitness requirements in the same way the Federal Police and state-level police forces do, the expectation across all levels of law enforcement is that you're a healthy specimen of humanity. You need to be the sort of person capable of handling stress in a healthy manner. As a frontline officer in particular, there's a fairly good chance you'll see some pretty foul things and deal with some filthy specimens of our species. You need to be prepared to deal with that.

What's in it for me?

But this is a computing and gaming magazine. Why are we even discussing careers in law enforcement? 'Cyber crime' – and we really wish there was a better term for it than that lame bastard of a phrase – is an increasing problem. Law enforcement agencies employ people who specialise in dealing with so-called cyber criminals. They also employ people to do all the usual IT department stuff: setting up and maintaining hardware, software and networks, helping people fix 'broken' computers by plugging in the monitor and organising collections of electronic documents into a usable resource.

That being said, most law enforcement agencies don't hire IT specialists as such. A degree in, say, computer science – even if you maybe did a couple of units related to digital forensics– won't give you a job with the police in Victoria, New South Wales or any of the other states. The exception is ASIC and the Crime Commission. Customs has a graduate program, although it's a case of a degree getting you into a training program (which, if you pass, will lead to employment) rather than directly into a job. The training and hiring regime is rather regimented: you need to apply by a certain time of year and, if you get past the initial application stage, you must attend interviews and training programs on other specific dates throughout the year.

Essentially, agencies such as the Crime Commission are in the business of hiring specialists. The state police forces, in their regular recruitment drives, are looking first and foremost for frontline police officers – the sort who walk or drive (or even horse) around the community, dealing with day-to-day, on-the-street police work. Specialists are typically hired and trained from within – and often only after a frontline officer has had a certain amount of experience and attained a certain rank. Like the defence force, much of the training is delivered internally to employees who either put their hands up, or are identified by their superiors as suitable candidates for promotion.

As with many jobs that don't actually require TAFE or university-level qualifications, a degree is still seen as a bonus. The Victoria Police website specifically states that anyone who comes to them with a Bachelor or higher level degree, such as a Master's, (the only set-in-stone educational requirement is that you've successfully completed Year 12) will automatically receive an extra 'point' towards their application. Keep in mind,

however, that even with this extra point, a degree is meaningless unless you meet the numerous physical and psychological requirements, pass a police record check, hold a (manual, not just automatic) driver's licence and so on. It's a similar story with the Federal Police: a degree will make you a more desirable applicant. The West Australian police force is unusual in that its training academy is partnered with Edith Cowan University. As a student and police force applicant, you can study for eighteen months to attain a qualification in criminology and justice.

> Specialists are typically hired and trained from within – and often only after a frontline officer has a certain amount of experience and rank.

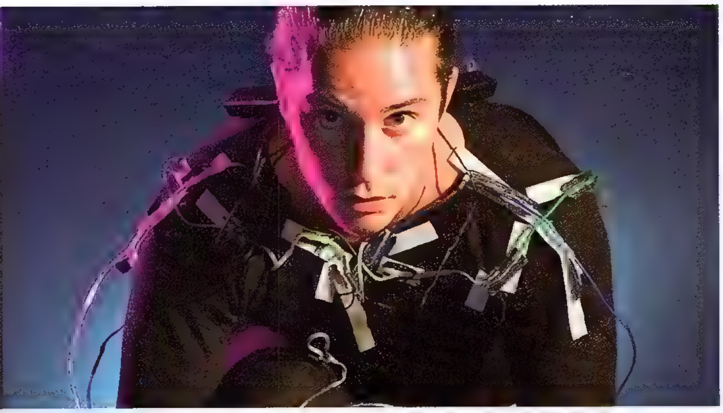
Crime can pay

The Crime Commission is a law enforcement agency that is relatively new – it's only about a decade old. These guys actually aim to hire IT grads, particularly from software engineering backgrounds. Those who've got Masters or even Doctorate-level degrees under their belt are looked at favourably. The expectation is that you know your way around computers. The Crime Commission is also interested in people who studied commerce, engineering, law and science. If your degree (or double degree) combined two or more of these fields, presumably you're an even more desirable applicant. They also like to hire people who have had prior experience in both the private and public sectors in fields including finance, law and information technology. They don't just want fresh-out-of-university graduates. Essentially, they're after a proven track record that you know how to put the theory you learnt at university into practice. Forensics degrees – which, in recent years, universities have gotten a lot of mileage out of, presumably due to the popularity of shows such as CSI – are looked upon favourably, but we'd advise against going out of your way to study them unless forensics is a serious passion for you. Whereas a computer science or commerce degree qualifies you for a number of varied things – so even if your desire to work in law enforcement doesn't come to fruition – the applications for a forensics degree are much more limited. The supply of forensics graduates exceeds the demand for them already.

ASIC also hires graduates from information technology and other fields, although as with the Federal Police and Customs there is a fairly rigid system of applying by a certain date and meeting the various hurdles they throw up within specific time frames. You need to be reasonably committed to working in law enforcement before applying to this or any other graduate program, given how much time and travel is involved.

Working in law enforcement has the potential, if you're the right sort, to be a satisfying and rewarding career path. At least at a federal level, the starting pay is okay. At all levels, there is a reasonable amount of room for advancement and career development.

Plus, who doesn't like an IT guy in uniform.



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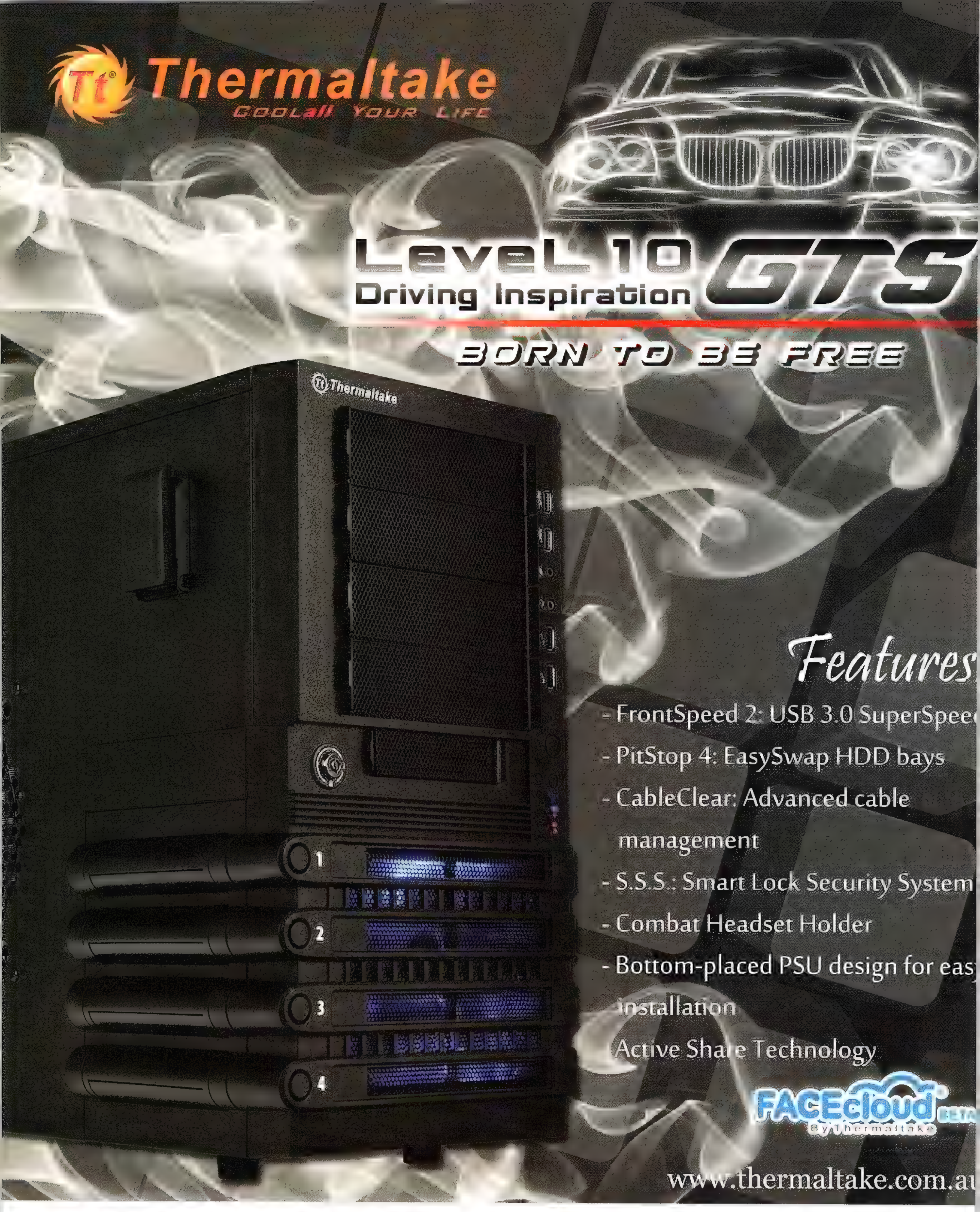

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GAMEPLAY

GAMES, GAMING AND GEEKERY COVERED... ATOMIC-STYLE

It's a far cry to say that Engine Room isn't fresh and exciting this month – yeah, we went out of our way to make that stupid pun, so please humour us. Seriously though, Ubisoft's trying to take the series in a new direction, so it's exciting to see where the games could head.

Then we've got a huge preview of XCOM: Enemy Unknown, bringing you four shiny pages on this strategic shooter. We follow it up with World of Warcraft's latest expansion, Mists of Pandaria, and we've got a phenomenal amount of content to pore over.

Finally there's our usual swathe of reviews, including Mass Effect 3 and the newly-released PlayStation Vita, wrapped up by everyone's favourite last page, Fallback.

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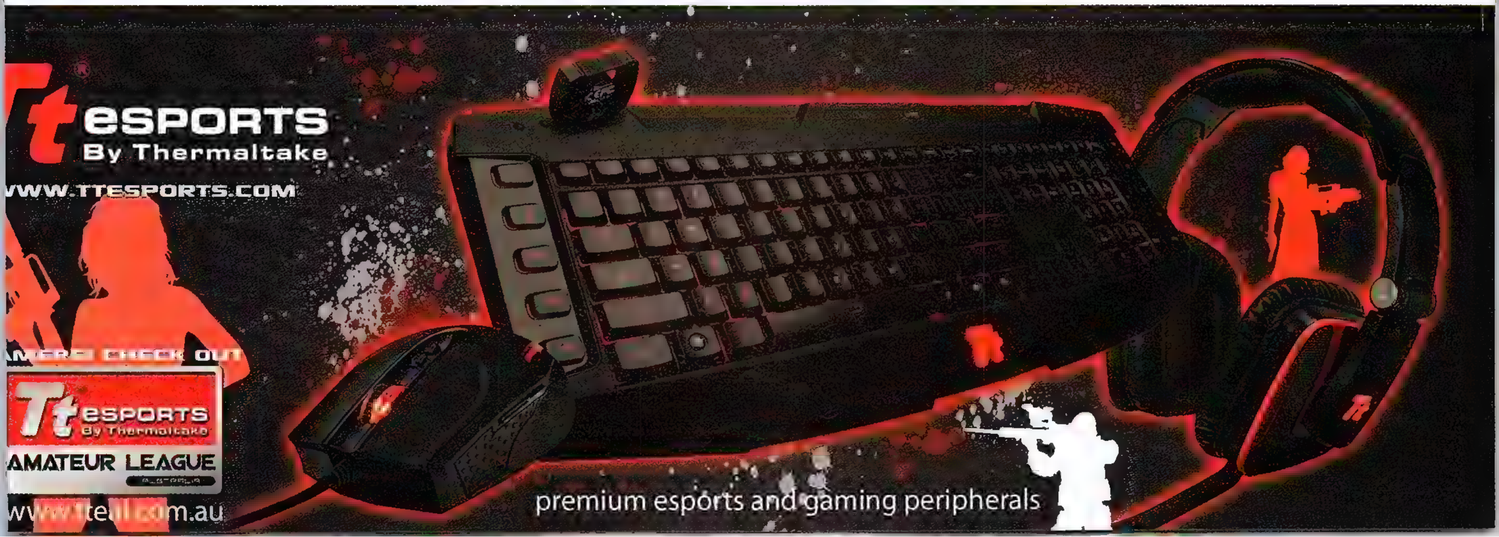


FARCRY3

Nathan Lawrence travels to Canada for a look at this epic FPS series.

If we were to choose one good take-away about the Far Cry series, it would have to be that it has the balls to take risks. From a Hawaiian-shirt-loving ex-military protagonist searching for a missing journalist, to a malaria-ridden Mercenary stuck in a war-torn Africa, Far Cry never had a problem ditching traditional lead characters, settings, or any semblance of sequel continuity. At its core, Far Cry is a franchise that is pushing the idea of what it means to be a shooter: the original game took gamers out of the corridors and turned an island paradise into hell. Far Cry 2 grounded the series and pushed for accessible realism.

With Far Cry 3, players can expect a whole lot more of the unexpected, as Ubisoft Montreal returns to an island setting with one key difference from the initial archipelago foray: this particular island is brimming with hints of a sordid history, and is teeming with insanity. We visited Ubisoft Montreal for a hands-off presentation of Far Cry 3, and a chance to sit down and talk with some of the minds behind this twisted title.

Press X to Jason

This time 'round you'll be jumping into the thongs of Jason Brody: a tourist doing the holiday thing with his girlfriend and brother, when the shit well and truly hits the fan. Jason is introduced in a polarising video that gives a clearer picture of his back-story, online at **www.atomicmpc.com.au/?290583**. The trio of travellers are captured by Vaas, the man that producer Dan Hay described as, "…probably a psychopath, maybe a sociopath. We're not sure what kind of -path, but he's not normal." You may recall Vaas from the Far Cry 3 reveal at E3 2011 and his sinister ramblings about the definition of insanity.

Jason, though, is the everyman caught in the worst of situations, and his fight against '-pathic' Vaas will be the core motivation to slug your way from A to B. We asked lead game designer Jamie Keen what hope an unskilled tourist has up against an island filled with murderers. "He doesn't start off with skills, but he's going to learn them quickly. The other thing is that players have a lot of those skills. So we don't want to choke it artificially. We don't want to feel like the player is being told, 'Oh, you can't do that yet because the character can't.' But, at the same time, we want to make sure you feel there is an expansion [of skills], and pretty quickly you get to a point where you understand what you're doing."

Dan hinted that they are trying to break Jason, and that he might not be the same man by the time the end credits roll. "Jason's experience is that he gets worn down, and then he starts to get adrenaline fuelled and lashes out. Then you see what's inside. We did that a little bit with the performances of [the actors]. You want to wear them down, you want to push them a little and you want to see what's on the other side of that push."

Singly important

You don't have to look too far these days to see that developers and publishers have figured out the best form of brand retention is to include a multiplayer component that can hold a player's attention long after the campaign credits roll. The downside of this awareness, though, is that single-player experiences can be an afterthought. We asked Dan how Ubisoft Montreal is keeping Far Cry 3's single-player fresh in a market dominated by shooters that have a clear emphasis on multiplayer.

"We want to offer a breadth of experience. It can be difficult to keep it fresh. With every single thing we looked at, we said, 'How would there be a unique experience in this?' Jason is a totally regular guy. And when we realised that, you actually see a guy who, the very first time he gets a kill, he's going to fumble a little bit. The first time he picks up a weapon to take guys out, it's not going to be perfect. We feel like the island and the characters, there's a rawness to it. If you get the feeling one of our characters could sit on the beach and have a drink with a little umbrella, that's not Far Cry. These guys have to be raw; they have to be rough. We create an experience where you actually watch somebody go nuts in front of you. You see what looks to be normal and then you watch as they open up and they show they are brutal inside."

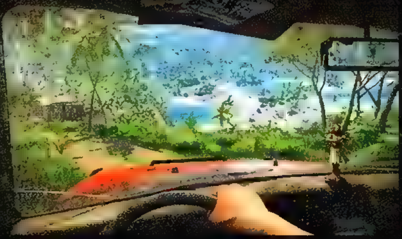
Whenever the team highlighted something different about Far Cry 3's approach, they were careful to emphasise they understood what was at the heart of the series: a shooter. Not just any old shooter, mind you; an FPS with an emphasis on 360-degree approaches to combat scenarios. This doesn't simply apply to your angle of approach, either, as Ubisoft Montreal wants you to play your own way. Run in with a shotgun, sneak around and cut throats, snipe from a distance, or jump on a hang glider and soar to your objective without killing an enemy.

Some of this was showcased in the opening level that Ubisoft played through, as Jason was tasked with disabling a radio scrambler at the top of a shipwrecked vessel, the Medusa. Guards were all over the ship, the beaches, and patrolling the water leading into the area. Initially, Jason took the quiet route, tagging enemies with his camera for easier tracking, as he slid his way from cover to cover. A silent takedown was soon offset by a burst of AK-47 fire into an unsuspecting enemy. It was a great way of showing you can go in loud, ninja, or change your style as the game throws curveballs at you.

Jamie expanded on this during our interview. "We want the game to be as much to as many people as it can be. We want this amazing shooter experience; we don't want to compromise on the quality there. We want players to have this really directed narrative experience. You don't tend to get that in a lot of open-world games. We want to make sure that we push the quality of all fronts, so if you want that narrative experience, it's there. If you want to go off and explore and lose time in the open-world, that's great. It's really this whole idea of enabling the player; never saying no to the player, and always giving them options and opportunities."

Weapons with character

This focus on the importance of characterisation extends beyond the cast of the game, though. According to game designer Andrea Zanini, players can expect a bit of personality from their arsenal, too. "In terms of wearing out, there's no weapon degradation [as in Far Cry 2]. But the weapons are worn; they're rough things. And for us that really plays to the character of a weapon. We've got more than 40 weapons in the game, ranging across all the classes, and our approach to them was that we wanted to treat each weapon as a character. Some of the characteristics of the guns, as well as some of the fantasies that players have of a gun, we dialled that up to 11 to really make each trigger pull as explosive as possible. On top of that, if you really like a gun but it's just not accurate enough or you want to use it in a sneaky, quiet approach, [you can] slap a suppressor on it, put a sight on there, and further enhance weapons through attachments."



Taking the load

It's always tricky for open-world titles to look pretty and maintain that all-important illusion of a persistent world by limiting or removing loading times. When asked about how loading times would be handled in Far Cry 3, Jamie had this to offer. "Our lead programmer says, 'No loading ever. It will be seamless, or I will kill you all.' And that's really great, because it means we're getting these pushes from everybody across the team, because the art director then says, 'I will not compromise on visuals.' My team is saying, 'Gameplay is super important.' So you have all these strong personalities and they all want to deliver this amazing game. Sometimes, for narrative purposes, you will have loads; but as much as we can avoid it, we want to keep the world seamless. Certainly when you're in the open world, no loads; or as close to it as we can get."

Dr Strange

While the island is open for exploration, there is a linear core narrative designed to offer focus and emotional engagement in the sandbox world. The second combat-free section followed directly after the Medusa mission. Jason is in need of medical assistance. His guide on the other end of the radio instructs him to seek out Doctor Earnhardt, a drugged-up GP who paints his house on a weekly basis.

Jason is ultimately sent on a fetch quest into a cave to find a mushroom that results in Jason tripping balls. This was something that sounded at odds to a first-person shooter at the presentation, so we were eager to hear how a drug-tripping fetch quest fits into the grounded world of Far Cry 3. Mark Thompson, lead level designer, showed us the light.

"If everyone [on the island] was just total screw loose, it would get boring. But the mushroom cave [mission] is very much what we thought would best represent the first experience you have with Doctor Earnhardt. It seems like it's just a fetch quest. The formula isn't new, but what we do is new. It's like every RPG ever, you go to a village and the first person you see says, 'Oh, hark young sir! You look like a brave adventurer, go yonder and fetch me a petal of the finest rose.' And then you go out into the fields, you come back with the petal of the finest rose, and the things you do on the way are just systemic. You might kill some level one rats, you might chase off a level two vagabond, but you come back and you go through the motions. We wanted to play around with people, because gamers expect certain patterns and formulas. So we make it a fetch quest but, on the way, we just explode what people think could happen."

Breeds of insanity

When the psychopathic tendencies of Vaas are put next to the drug-loving oddness of Doctor Earnhardt, it's difficult to fathom how Far Cry 3 can still be a grounded experience; believability being something Ubisoft Montreal is striving for. Initially, we weren't convinced that this sort of polar-opposite craziness could exist organically in the same game world. After we challenged Mark, we were comforted by his reply.

"It comes down to the things that the characters do and little details about them. We make sure all of the characters have something about them that you can connect with. Things like the way the doctor paints his house. It's something normal he does to try and ground himself because he feels like he's on the edge of reality. We make sure all of the characters have something real about them. Vaas has those scars on his head. He does that because he shaves his Mohawk with his machete. The art directors always look for that little thing in a character that makes them feel real. They don't just put a scar on a guy because it looks cool. There's always a story behind it, and that story makes that character realistic and credible."

It's just better

While Far Cry 2 may have been a solid shooter experience across the board with some interesting ideas, there's no denying it was also flawed. Andrea Zanini, game designer, was the first to share what the team had learnt from the mistakes of Far Cry 2.

"There's no malaria, or something that you

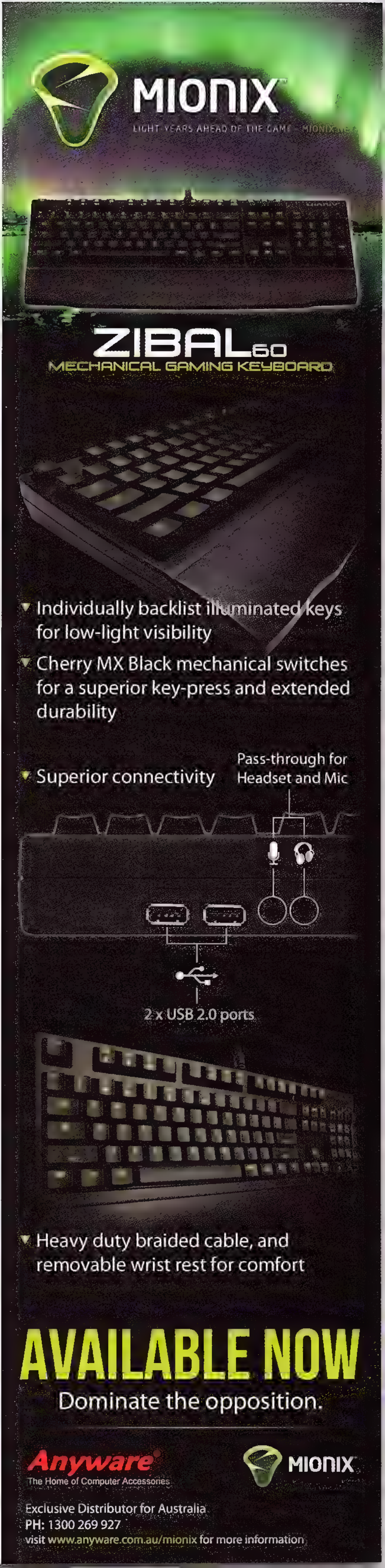
need to upkeep or maintain. We listened to the fans. For health in Far Cry 3, being and surviving on the island is also part of that experience, in terms of what the island has to offer to help [Jason]. In terms of the player's actual health mechanics, there is a minor regenerative system in there, but if you take a big hit, you're going to have to take care of yourself. That's playing back on grounding you in the moment. If some big explosion went off that was your fault, now you've got to deal with it."

Dan was quick to highlight that while the perpetually respawning enemies of Far Cry 2 have been addressed, there were also some positive elements they took from the last game. "Far Cry 2 did a lot of great stuff and there are things we can take from it: they had great procedural fire and we were like, 'Bring it in.' It had a huge open world, and we wanted to take elements of that. But we're being selective and making sure if Jason goes into an area and is able to take it over that, through the story, if you turn around and go back, it makes sense what you see. If you go in and wipe everyone else out, it's going to feel like it's your territory now. And we were super careful about making sure that we tried to be authentic about that."

Gone walkabout

Despite the linear story, Far Cry 3 is designed as a sandbox experience. Best of all, if feedback from Ubisoft's playtests is to be believed, the tropical island will be working hard to lure you off the beaten track. Jamie offered justification for why he felt you may be tempted to go against your normal FPS inclinations. "I want this to be an engaging open-world experience. I feel like the game really comes alive when we put it into play test, and the most diehard of shooters or the most mainstream of mainstream players, at some point, you'll see them driving along and they'll just yank the wheel and be like, 'What's that?' And they'll just head off. And, for me, that's really where the game comes to life, when you see people kind of go, 'I want to go and find out what that is.' We want to make sure the player's curiosity is piqued and when it is, they are really rewarded for that."

Our curiosity is officially piqued, and we were fascinated by the risks that Ubisoft Montreal is taking with grounded insanity. We look forward to staring into the abyss when Far Cry 3 is released in September this year, and we hope that it stares back.



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PREVIEW

XCOM: Enemy Unknown

Atomic travels to New York to get the scoop on this much-anticipated sequel.

The response to the news that 2K Games is working with Firaxis to 're-imagine' the classic XCOM: Enemy Unknown was almost universal. It was a mix of nostalgia-powered 'hell-yeahs!' with a certain trepidation that if you're going to re-do one of the greats, you're going to want to do it well.

Very well, in fact.

2K Games is certainly aware that the game's in an interesting spot, so it recently spared no expense to get a mess of journalists to New York to view a special hands-off preview, and chat to the designers and developers behind this epic of alien paranoia. Atomic was there, and before we dive in deep, let's just calm all you fans down right now...

It's looking pretty damn neat.

Even better, the Firaxis guys are very aware of the burden they've taken on, working on such a beloved title. "It's a double-edged sword," Greg Foertsch, lead artist, told us. "You're remaking one of the best games ever; it can be really daunting or absolutely inspiring. But we're a little bit used to that now," he added, and with a lot of Sid Meier classics under Firaxis' belt, it's a fair claim. "You don't get chances like this every day."

In fact, it's worth exploring up front how the whole idea came up, from Greg's perspective. Is there a bit of paper pinned to a wall somewhere, like a giant, geeky to-do list?

"Yeah, it's pretty much that," he said, laughing. "We had kinda finished some things, and Jake [Jacob Solomon, lead designer, who we also spoke to] and I were sitting around, and I started talking, and we had some lead time in between projects. I'd come off of Railroads, and was helping out with CivRev until the next thing came up, and it was only a couple of months until we thought... Let's make XCOM.

"It's one of Sid's favourite games of all time, and it's certainly one of mine. And so I was all in; it's got aliens and dudes with guns... so let's do it. We started talking and started pre-visualising what it would be, and we realised we had something pretty cool."

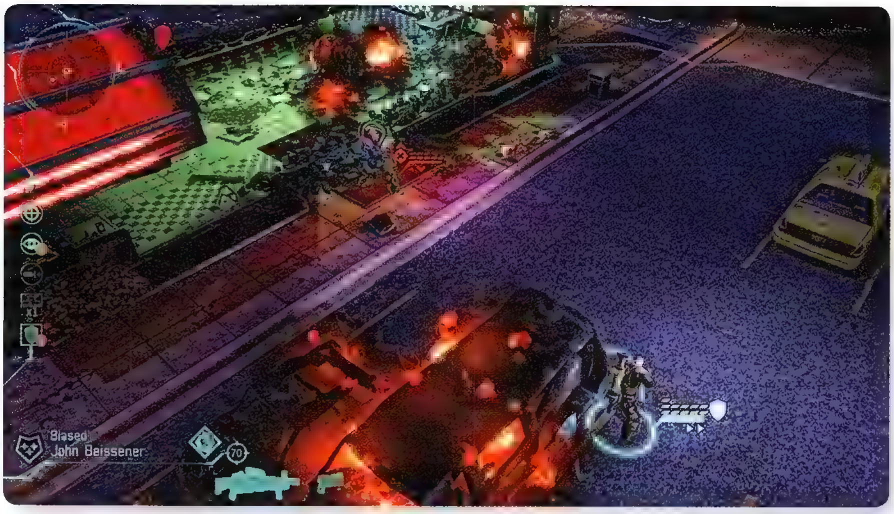
Jacob was much more sanguine. "I was even more behind the idea of making the game," he admitted. "It was one of the main things that got me into the business, because I played it in High School, and I knew it was what I wanted to do. I'd worked on lots of Sid's games, but the idea of making this game, that's my dream job."

But that passion doesn't come without a price, as we got Jake to admit. "When I started this project I it did it with stars in my eyes," he said, wistfully. "I had this real fan-boy perspective that *this* is how XCOM works. People would raise some reasonable objections and I'd tell them they just didn't understand." But that's the problem: you really believe that you 'get' the game on many more levels than everyone else.

"I was resistant to a lot of things early in the process. But it's different being a fan of the game, and being the designer of the game; with one you appreciate the systems, but in the other case you're responsible for the systems." Until Jake started to feel fully responsible for the game's mechanics, he would find himself justifying why the original did something one way rather than looking to innovate. "Eventually, though, you kick into designer mode; you have

to evaluate everything fairly, and when I started my first prototype of the game it was very, very true to the original. Then one of the things I wanted to do was add more RPG elements; it seems like a minor thing but when you put systems on top of this already existing game it just... you can't just clamp stuff on like that. XCOM was never built to have all these extra abilities, these extra things that you're doing. You start to have UI issues, design system issues... as we realised that we knew we had to start re-evaluating *everything*. It just wasn't working as well as we liked."

In effect, the team had to start again from scratch, from first principles, to develop the game they ultimately had in mind. "If we wanted to have a turn-based, tactical game, with all these soldier abilities, what's the best way to do that?" That's when Jake and the team realised a lot of changes were needed to bring it in line with their desires for the final product.



A day at the (ant) farm

In a lot of ways, the stretch of gameplay we were privy to is classically XCOM in its feel. We didn't get to see a lot of the strategic layer in depth, however, and while I can say that the cutaway 'antfarm' view looks fantastic, most of the demo followed a typical tactical, turn-based mission. Quickly, though, the ant-farm looks really wonderful; not only is it a fascinating visual representation of your base's structure, including add-on elements you've chosen, but it's also a living, breathing snapshot of your current game.

In between missions you'll be able to watch as your soldiers and operatives recover, train, and conduct research. It's the kind of thing you can easily get distracted by, though of course the game will make sure that you don't get distracted for too long. There's a whole world to keep safe from alien invasion and abduction, technologies to research, and units to train.

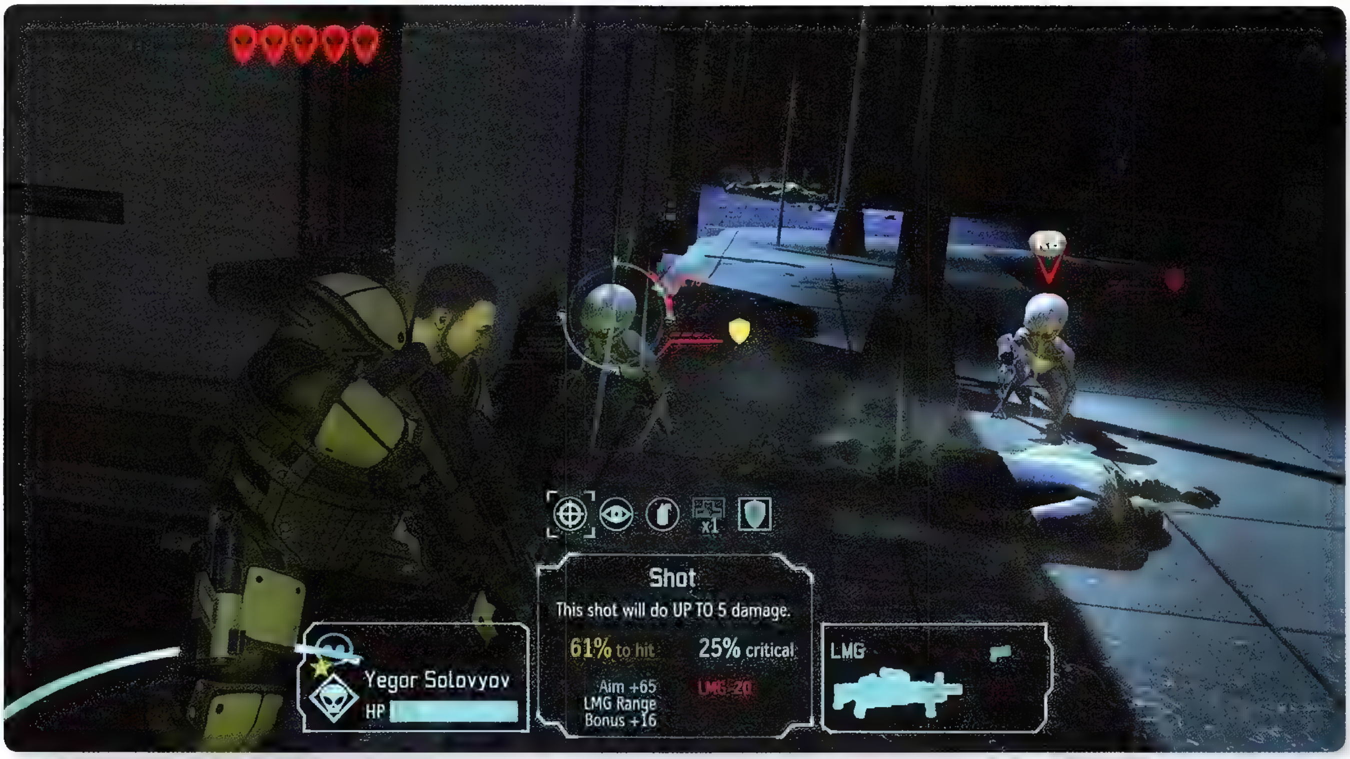
We saw a hint of the latter, though, and while there's still a focus on researching new gear and inventory management, an individual operator's skills are even more important. As you train your little guys, you'll advance their skills through different class-based skill trees – and it looks like there's a mess of scope for some insane customisation.

No matter how carefully you plan or train, though, you're going to have to get your hands dirty at some stage, and the new take that Firaxis has on turn-based tactics will have the micromanagers among you drooling.

It's all about teamwork

"We have an advantage that other games don't have, in making a game feel more cinematic," Greg boasts, about the structure of XCOM's tactical gameplay. What he's referring to is the open nature of the turns, and how it allows the game to more purposefully take control of the game's camera. "When an FPS does it, in a cutscene, a lot of gamers don't like losing control, but we do it every turn, and it rocks."

One of the big changes that Jacob was referring to above was the removal of time units from the game. Many turn-based games, like XCOM in the past, feature a finite resource that measures how much a given unit can do in a turn. This often tied into a grid that underlies the game world, so if moving a square would cost



Oh look, men with guns... again

It occurred to us while we were chatting to Greg that coming up with a unique, yet satisfying and recognisable look for what are essentially modern soldiers with guns must be a real challenge. And, guess what – it is. But, clever clog that he is, Greg had an interesting take on it.

"You know, there are a lot of games out there that do good work with their models. I mean, you can't get away from things like Modern Warfare and the whole guys with guns things," he admitted. "So we had to come at it from a different direction. Rather than think of XCOM's soldiers as people, we started thinking of toys – of action figures – and what makes them cool. You know, how they bend, and what makes one toy cooler than another toy. From there, we actually found it pretty easy to come up with something that looked good, looked right, and looked different."

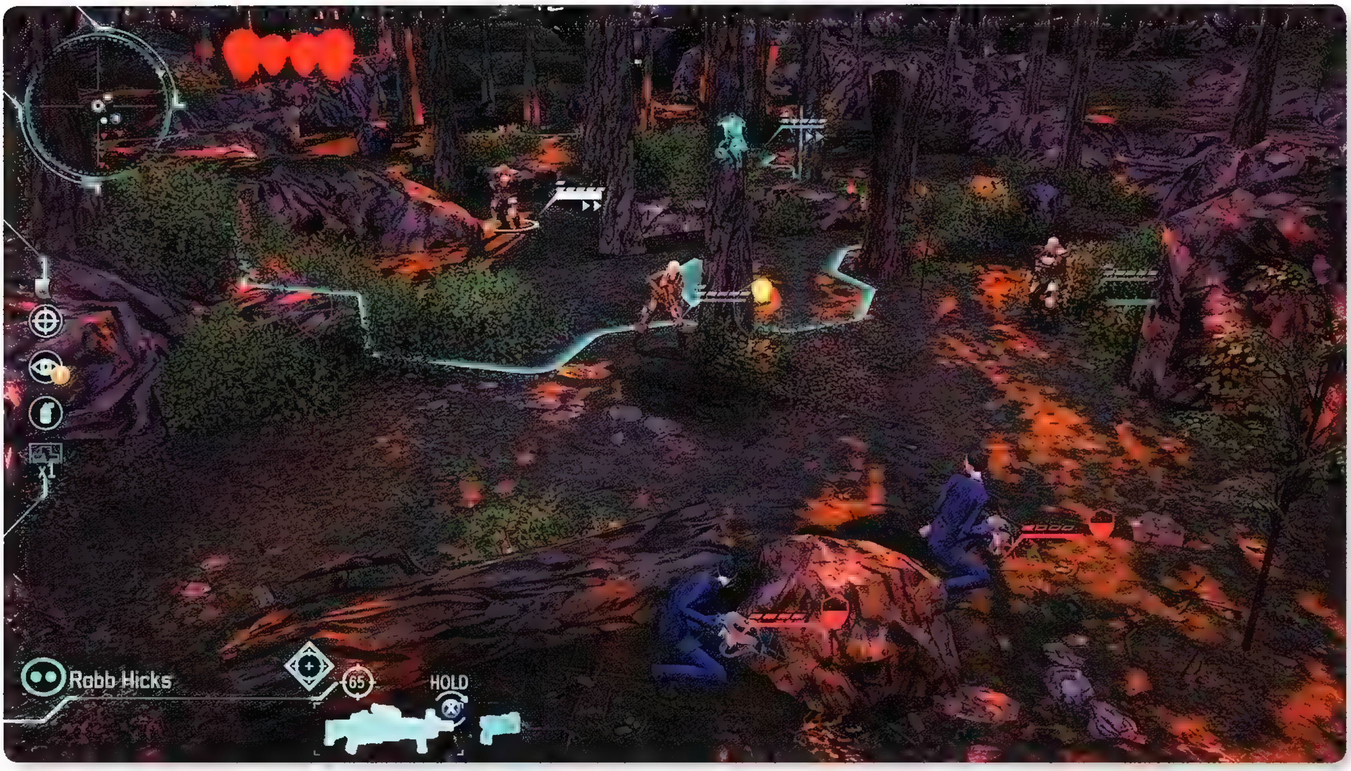
one unit, so would shooting, and so on. XCOM: Enemy Unknown does away with these, while also ditching any kind of initiative system for units. The turn structure is a simple my-turn-your-turn mechanic, but what you end up with is lot more gameplay depth, and opportunities for fluidity. Instead of time units, the basic mechanic is this: the more you move, the less you can shoot or deal damage.

Our demo featured four soldiers going after a two groups of aliens; it was short, but very illustrative of the almost puzzle-like feel of combat in XCOM. Flanking and support fire are possibly two of the most important elements of the game's combat, and it's one of those easy to learn, difficult to master set-ups. In dealing with a small unit of Sectoids – the traditional XCOM villain – our demo driver set up lanes of cover fire and flanked the enemy for some strafing fire, while other units used more specialist abilities, unlocked by skill tree choices – like the sniper's ability to scale buildings for a height advantage.

"We've added these abilities, and we want the player to use them, to use their soldiers together," Jake told us. "We wanted players to look at the battlefield and come up with a plan – a lot of the joy in tactical games is that feeling of executing a plan, and planning multiple moves ahead. But people wouldn't do that with time units; they'd look at the units, and think only about that soldier: move, kneel... do I still have enough for reaction fire... Because it wasn't a discrete enough system, when we added that sort of move or shoot discrete choices, players started looking at the game differently." In other words, they'd look at the entire situation and move the whole squad appropriately. "That was one of those big moments, when we took them out, and a little scary, but when we played with it, the whole team was, like, this is better."

Everything else you expect from XCOM combat is there – timed weapons like grenades that tick down to inevitable destruction, overwatch fire to keep your approaches covered, and of course, lots of destructible and explosive terrain. The demo mission was fought over an abandoned petrol station, with predictable and satisfying results.

To return to Greg's claims about making



cutscenes cool, because the turn is in effect already staggered into discrete moments of player intervention, inserting brief in-engine cutscenes really make the game more cinematic. So when you successfully snipe an alien goon from a rooftop, the camera pops out of the locked isometric view to let you see it in detail.

Or, if you mess up, to let you see one of your highly-trained, worth millions of tax-dollars soldiers get chewed up into goo. But Firaxis know they can't get carried away. "Everything we do is about the player experience, not what my grand vision is, or what artists want to do."

But is it really XCOM?

That's the hard question. But we believe that, despite the changes and additions to the game, we'd have to say yes. Once you take the lenses of nostalgia from your eyes, you start to realise that there a lot of clunky things in the old iterations, and that gameplay design has come in leaps and bounds. XCOM was great, no doubt, but do you really want to go back to that cramped UI?

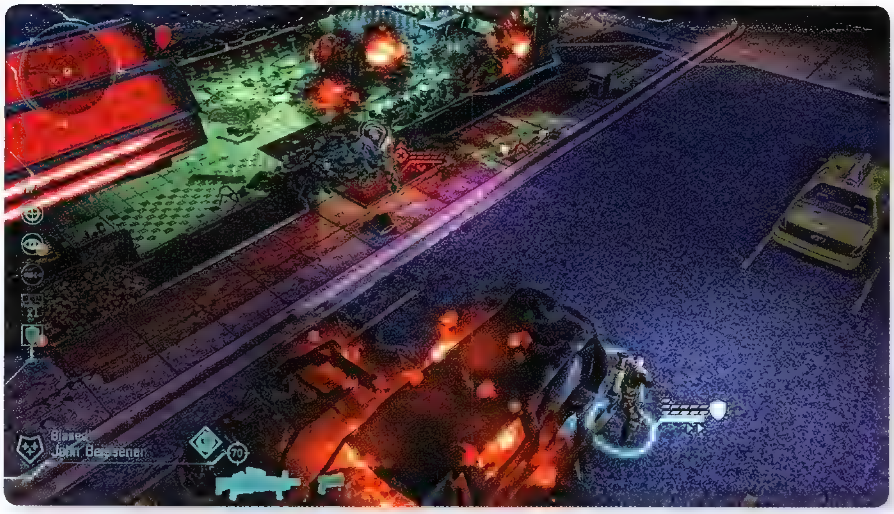
But the things that made the original such a classic are still there, we're told. For one thing, the game's much easier to get into now, which, given the scope of the game, is vital. Greg told us "I went back to the original, 'cause I really wanted to see what made the original so great, and it was a real shock. It's brutally unforgiving and dense." At the same time, with nearly twenty years of game development, its pacing was way off. "The game started and I sat there waiting for something to happen for three minutes! You can't do that in a modern game."

> "It's one of Sid's favourite games of all time, and it's certainly one of mine. And so I was all in; it's got aliens, and dudes with guns..."

But back then, no one knew any better, and being such a ground-breaking game, there was little to compare it to. "But now we know better," Greg says. "It's much easier to get into, now."

So should veterans be worried? "Oh, no. We're designing so anyone can jump right in; you've got to learn the game, and the UI, but we've really expedited that, in a way that's compelling and fun and seamless. The vets won't even notice that they're learning."

Probably the thing that would worry most old timers is that Enemy Unknown is coming to consoles as well as PC. They might be forgiven for expecting a certain 'dumbing down' of the game, but Greg assured us that wasn't the case. "We've added a lot more complexity into the game, actually, what with the soldier skills and levelling, combo moves, stuff that even old players are going to think is really cool. We've taken some complexity out, boring stuff like ammunition tracking, but added in stuff that we think is more complex."



One of the big differences in the platforms is in the control inputs, but that's actually been no issue at all. "Really, when you get down to it, there's not a lot of buttons you need to use," Jake said. "We've not even used all the buttons on the console controller; we didn't feel like we had to, so there's no real loss of control on the PC version, because it's just as simple."

"When we made CivRev [for console] we knew we wanted to condense that experience down to something that the console could manage, but with XCOM the goal was to say we're really making the real XCOM – it's just gonna be on all these platforms." The 'complexity in simplicity' design of the game simply meant that condensing controls was never even an issue.

So we're excited. The game's going to be big, different every time you play it, and with reams of areas of customisation, right down to the nationality of each of your elite alien-hunters. Even more hopeful, it's made by a team of devs who are passionate about the original, but not afraid to make it better than the original.

This could be something exciting... **DH**

Xbox, PS3, PC (Previewed on PC)

Developer Firaxis
Publisher 2K
Website www.xcom.com/enemyunknown

✓ Revitalised series, tactical gaming in the modern age.

✗ Many changes to an old series that may not be perfectly executed.

Anticipation rating

We can't wait to get our hands on a finished XCOM in late 2012.

85%

atomic INTERVIEW

CD Projekt RED and The Witcher 2 Enhanced Edition

We take a look at the Enhanced Edition of The Witcher 2, and also interview CD Projekt RED about a bunch of PC-related things.

We recently had the opportunity to check out The Witcher 2: Assassins of Kings Enhanced Edition at the offices of Namco Bandai. While primarily focused on the upcoming Xbox 360 port of the game, two members of the CD Projekt RED team flew out to support their product: Agnieszka Szostak, marketing specialist, and Mateusz Tomaszkiewicz, senior quest designer.

During the initial presentation, Agnieszka and Mateusz highlighted the features that Xbox 360 users could expect to enjoy in the Enhanced Edition of the game. A new game introduction created by BAFTA Award winner and Academy Award nominee Tomasz Baginski sets the scene, while additional animations and cinematics will also be available. There's an extra four hours of gameplay to be found, which introduce three major characters, and they hinted that they have yet to announce the full list of content that will be included in the game.

By far the greatest news, from a PC perspective, is that when the Xbox 360 version launches on the 17th of April, The Witcher 2 owners will be able to download the additional content free of charge in a game update. From what we saw and played of the Xbox 360 version, CD Projekt Red has done a phenomenal job of maintaining a lot of the visual prowess of the PC version on the Xbox 360 and, considering this is their first Xbox 360 title, this is no small feat.

We had the chance to sit down with Mateusz to discuss all things Witcher 2.

atomic If you've got returning PC players who've played the whole way through The Witcher 2, why would they want to come back and play the Enhanced Edition?
Mateusz: Obviously, because we've got all this new content, right? Not only two new quests, which I mentioned earlier, we also have completely remade the epilogue of the game, which is a big thing, in my opinion, because, as I said before, we have added those movies which sum up the choices you make throughout the game.

atomic So it's a gameplay section as well as videos?
Mateusz: It's a gameplay section. It changes the location.

atomic It changes the ending?
Mateusz: Yeah, which shows the implications of the things that you did in act three.

atomic Alright. In Australia, we're still very backwards with our classification system and, as I noticed when I checked the report for The Witcher 2: Enhanced Edition, you guys have submitted a modified version. What's your experience been like working with our backwards classification system?
Mateusz: It's a tough question. We had to censor something, as you probably know.

atomic A sex scene.
Mateusz: Two of them, actually. But it was not about the sex, per se, but the sex as a reward.

atomic They have a problem with that?
Mateusz: Yeah. I dunno. Did you play the full game?

atomic Not the full game, no. I haven't
Mateusz: Well, I won't spoil it for you, but there were two quests in which it was a reward, so now in the Australian version when the player is offered this, Gerald will always say, 'No, thank you.'

atomic He turns the sex down!
Mateusz: Yeah. Unfortunately.

atomic So, in the original version, you have a choice to say yes or no?
Mateusz: In the European version, you do.

atomic I read a while ago about the piracy statistics of The Witcher 2, and it was completely disproportionate to the copies that you sold. Not long after launch, you guys removed the DRM from the game.
Mateusz: Yes.

atomic Do you guys regret that decision?
Mateusz: No, we don't.

atomic Why do you still take this approach when you've got so many people like Ubisoft that have 'online all the time' DRM?
Mateusz: DRM affected the performance in

the game. It was in the game at launch, but we removed it when we noticed that it affected the game. So we decided that the DRM is not important for us at all. And the game is the most important thing. So we removed it. And on the other hand, we believe that DRM is not the way to make sales because there are two things. First of all, those people who are pirating the game, wouldn't buy it in the first place, in my opinion. Or they are pirating it to check how the game plays because we haven't released demos, and they go and buy the game anyway; if they like it, of course. And the second thing is that I think that if the people want to crack the game, the security systems, they will do it anyway.

atomic Being primarily a PC developer, what knowledge and tricks have you taken across when developing on the Xbox 360, and/ or vice versa?
Mateusz: Well, I, for one, have learnt very much about optimisation while making the Xbox version, because now that we've made it, I see how many things I could have done differently while doing the game for PC. But, y'know, when you're making a game for PC, you have this unlimited memory because you can just add it to the computer, so you, at times, don't think about such things as optimisation. Optimisation is the most important thing I've learnt on the Xbox.

atomic So when The Witcher III comes out, it'll take optimisation things from the Xbox-
Mateusz: -and put them on the PC, yes.

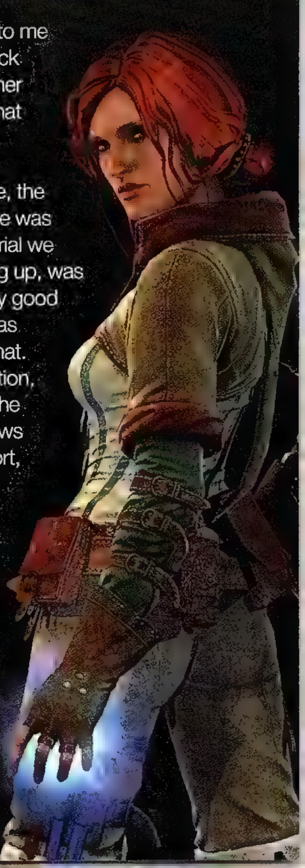
atomic So, I guess, that would technically mean that that would create a lower minimum spec, because the specs for The Witcher 2 are quite high.
Mateusz: Yes, I know.

atomic You've mentioned that you've got an intelligent camera for the Xbox version. In the past, particularly on consoles, whenever someone tries to instigate an intelligent camera that moves intuitively, it inevitably hits points where it gets stuck behind walls, so you can't see what's going on in the middle of a battle. How are you guys addressing that, and is that something that's been carried to the PC version as well?
Mateusz: The intelligent camera to the PC version... I'm not sure about that, to be honest. And about the issue with the walls you mentioned, well, it's quite unavoidable at times, it happens. But I think that we managed to overcome that. If the camera gets stuck behind something, the object dissolves, so it shouldn't be that much of a problem.

atomic Has the dissolving technique worked well for you so far?
Mateusz: Yeah. I'm sure that there may be some moments where the camera will get stuck, but it happens in all games, I guess.

atomic Can you talk to me about any specific feedback that you received from either critics or the community that has helped to shape the Enhanced Edition?
Mateusz: We had, for one, the feedback that the prologue was too hard and that the tutorial we provided that was popping up, was not enough. That was very good feedback. Because now, as you know, we've added that. And for the Enhanced Edition, the feedback we had on the forums and from the reviews that act three was too short, that the epilogue was too rushed. So we've made act three longer. We have changed the epilogue so that it is more satisfying, right now, I believe.

atomic Thanks for your time. **NL**

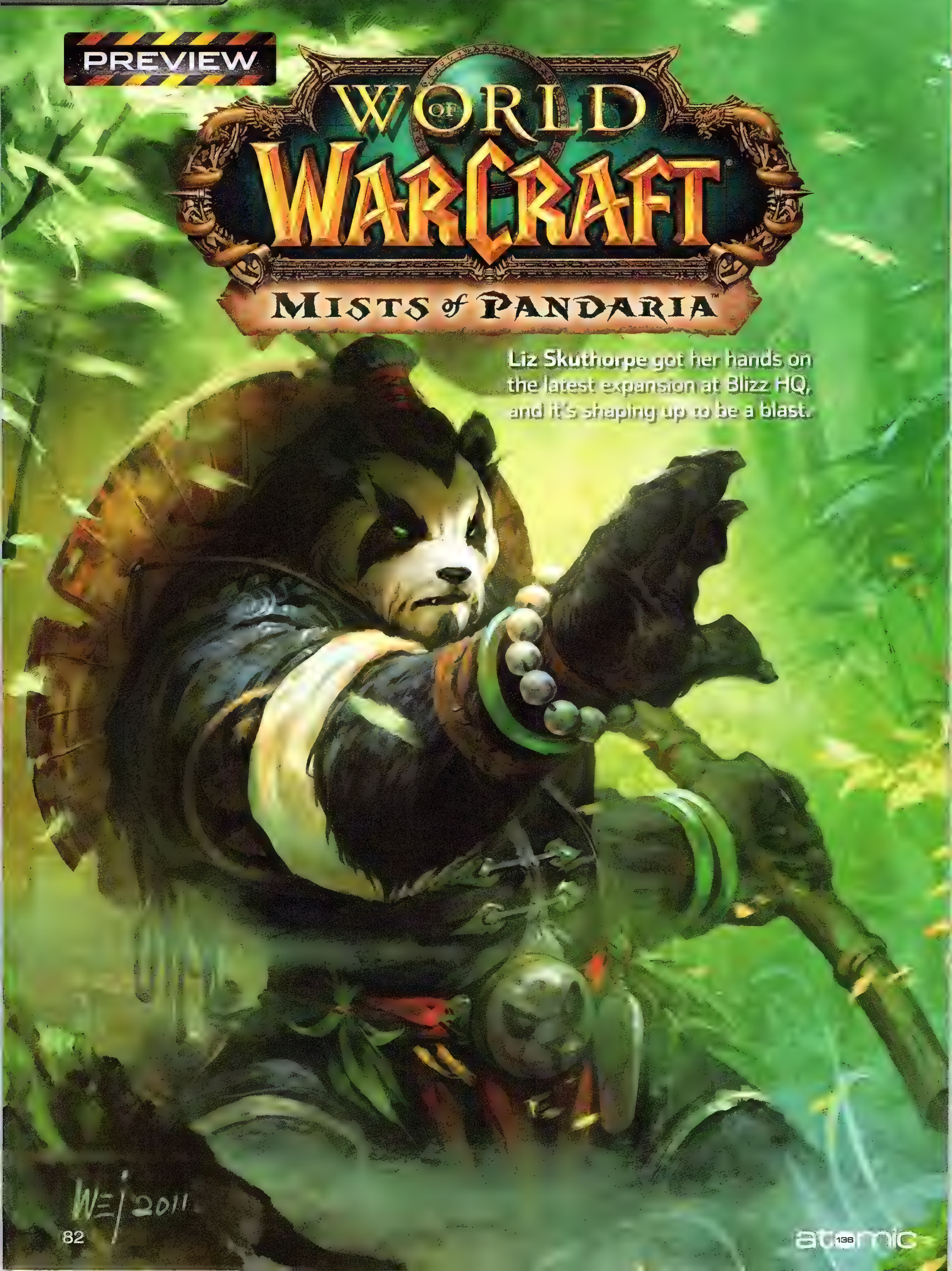


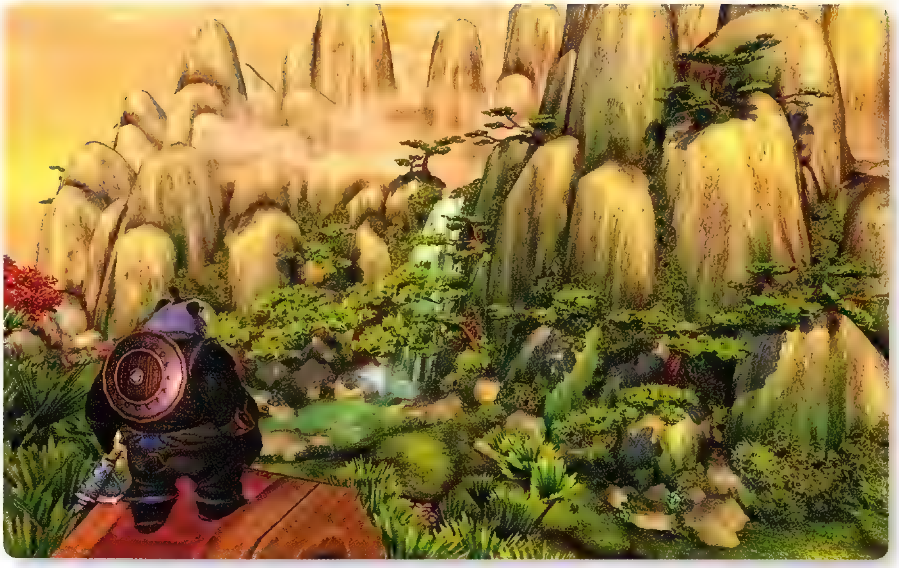
PREVIEW

WORLD OF WARCRAFT

MISTS of PANDARIA

Liz Skuthorpe got her hands on the latest expansion at Blizz HQ, and it's shaping up to be a blast.





In many ways, Cataclysm was a troublesome expansion for Blizzard. By undertaking such a total rebuilding of the world, the developers limited their ability to produce new content, particularly at an end-game level. When that was combined with new zones that heavily utilised cinematics and strongly narrative quest lines (Uldum and Harrison Jones, we're looking at you), the result was a quietly grumbling community. Players complained of a lack of options at level cap for those not interested in heroics and tiered raiding, and Blizzard has repeatedly stated that it has learned lessons through community feedback and its own experiences and has promised gameplay options for gamers of all stripes.

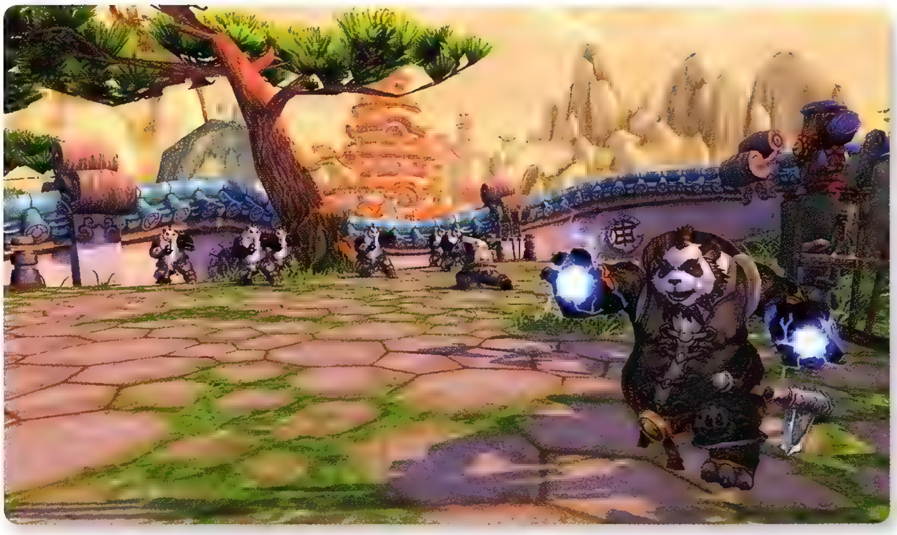
What will we find in Mists of Pandaria then? While the inclusion of the Pandaren might seem too cute and fluffy to some, the inter-faction conflict that's been brewing between the Alliance and Horde will be the main focus of the new content and its follow-up patches. Players will have been aware for some time that the developers have been moving towards greater conflict between the two sides. Chris Metzen, VP of Creative Development, revealed that the war itself will be the focus of the expansion, in lieu of major villain, and described Mists of Pandaria as "the spiritual successor to classic World of Warcraft." Although the shipped game will feature a more open adventure and exploration vibe, a villain of sorts will appear throughout the later patches, which will culminate in a battle called "The Siege of Orgrimmar," Metzen said. "We're leveraging all our main characters in one way or another... It will feel fairly tragic, but it will feel fairly heroic when all is said and done."

Shipwreck on a mysterious isle

Although it has existed since before the Sundering, Pandaria has been obscured by magical mists that caused its inhabitants to be unable to see out to the rest of the world. Travellers from beyond inevitably lost their way before being shunted back out to the Great Sea. Now in the aftermath of the Cataclysm, the mists have dissolved, and both the Alliance and Horde naval fleets discover the new land while skirmishing. Destroying each other's fleet, Horde and Alliance arrive in Pandaria as shipwreck survivors, bringing their war with them. The first area, the Jade Forrest, seems initially idyllic, though it soon becomes apparent that the Pandaren have problems of their own: the Sha – embodiments of negative emotion. At least one of the Sha will appear as a boss in the first new dungeon, The Temple of the Jade Serpent.

The Pandaren: brewing, farming, butt kicking

Known as great brewers, farmers and spiritual powerhouses, the Pandaren have a long history as the shepherds of the other races on the Isle and keepers of the peace. Controversial though they are for some players, the environments and design for the Pandaren race, and the Isle as a whole, is of an incredibly high standard. All the new zones have a beautiful Chinese-inspired aesthetic and it's safe to say that the system



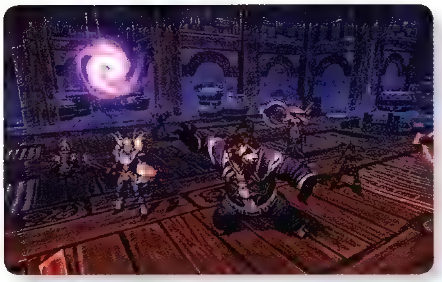
Gotta catch 'em all

The Pet Battle system will definitely be available for Mists of Pandaria, and we were able to check out a basic interface for the mini-game. While there's still work to be done on the interface it seems safe to say that the implementation will be a lot of fun. If you're into Pokémon...

Players will be able to queue up for pet battles, and Greg Street announced that one of the important aspects of the battles is that player names won't be displayed – a way of avoiding "the shame of defeat", with the intent that this should remove one of the barriers to people jumping in. If no one can smack talk you afterwards, punters will be more likely to queue.

Six pets will be available for battle, but you'll only be able to have three out at any one time, so you'll need to be somewhat strategic with your abilities. During the expansion preview we saw an epic battle between Illidan and Arthas, each swapping in appropriate pets or replacing them when they were defeated.

No word as to whether the pets are healed post-battle, or discarded and replaced with a fresh one.



requirements for the next expansion will increase. Also, playing through the level 1-10 zone for Pandaren, it's clear that this portion of the game is pretty much ready to ship.

Metzen also revealed that the Pandaren have been on the cards as a playable race since before the release of The Burning Crusade, when they were under consideration as the new Alliance race, though that place was eventually taken by Draenei. It's also been confirmed that Chen Stormstout will be making an appearance, and players will be able to get involved with Stormstout quest lines.

We've also finally met the female toons for Pandaren – and they are cute! But if you're a fan of the female Dwarf design then it's fair to say to say you'll like the female Pandaren.

How to train your Cloud Serpent

Fancy a dragon mount?

(Well, serpent really, but it's cool!)

It takes around 20 days of daily quests to care for a Cloud Serpent egg and raise a dragon. After completing some further riding quests you'll have a new mount! There's also a racetrack where you can test those new riding skills. Sadly you can't burn the villagers with your wing-a-ling dragon, but you'll look hella cool.

Monks

Once oppressed by the tyrannical Mogu, the Pandaren developed an unarmed fighting style and mastered the use of positive energy – a cousin of chi – to protect others, and so developed the Monk's abilities. The greatest of this warrior caste are the Shado-Pan, a faction located near the peak of Kun-Lai.

The play style for monks is a little different to existing melee classes as they have no auto-attack. That said, with the prevalence of rotations and priority lists in high-end content, most players are used to waiting out global cool-downs before triggering their next attack anyway.

During hands-on time with the latest iteration of the Monk build we really didn't feel the lack of auto-attack damage negatively affected the class. However, one consideration is how badly latency will affect Australian players.

The combination of energy and chi as dual resources feels intuitive and not completely alien, thanks to systems such as the Rogue's combo points, or the Death Knight's runic power. Monks have four chi spheres to generate, as well as their resource bar. Melee attacks generate chi, which can then be used for abilities such as healing or special attacks.

A key feature of the Monk's play style is an extreme focus on movement abilities, in and

The Pandaren have been on the cards as a playable race since Burning Crusade, though that place was eventually taken by Draenei.

New Zones and Areas

We got a decent look at some of the new levelling zones, including The Jade Forrest where players will first start, then eventually work their way inland to the Valley of Four Winds. Other zones include The Wandering Isle, Townlong Steppes, Krassarang Wilds, the Vales of Eternal Blossoms, Kun-Lai Summit and The Dread Wastes.

Valley of Four Winds

This zone is really the heartland of Pandaria, and is the rural, agricultural centre of Pandaren life. Farming is key here; the Pandaren grow giant vegetables fed by Sacred Waters, which feature heavily in the new continent and appear to be a kind of power source in dungeons like the Stormstout Brewery. In this zone players will also get a taste of the developer's new approach to increasing reputation with different factions. Dave Kosak acknowledged that players were approaching the reputation grind as a real chore, one they abandoned once the requisite level was achieved.

In Pandaria, the developers are attempting to make factions more engaging, and one way to do that is to have players invest in things like the Farmer's Faction. In the Valley of Four Winds, players will encounter the hapless Farmer Yun who is having trouble with his farm. By assisting him, players will see cosmetic environmental changes around the farm – think of the phasing environments we've already seen in the Firelands daily quests. Eventually, players will be able to access this farm for consumable items such as food and herbalism recipe components. The growth and cosmetic changes in your farm represents your growing faction ties with the Farmers.

The Krassarang Wilds

Home of the Mogu, who once controlled all Pandaria and now live in the remnants of their glorious empire.

Kun-Lai Summit

Location of Mount Never-Rest, the highest Mountain in all of Azeroth, and notably the home of the Shado-Pan monastery. At the foot of Kun-Lai you'll find the Tauren cousins, the Yaungol (Yak + Mongol!); pushed out of their own lands they're fighting for living space.

Townlong Steppes

Once the home of Yaungol and now home to the insectoid Mantid, recently 'awoken' (sounds familiar, wonder who woke them up?).

Vale of Eternal Blossoms

Once the seat of the Mogu Empire, here you'll find the Lorewalkers – for those who really want to delve into Pandaria's 12,000-year history.

The Dread Wastes

Not seen in the preview, but we've heard that Sha roam free in this level 90 zone. Players will need to travel this zone to solve the mystery of what is actually happening to Pandaria.

out of combat zones. Even at a low level the movement abilities are extremely effective, and definitely give the impression of awesome martial arts movie action. Greg Street, Lead Systems Designer, said we can expect to see completely new class animations for the Monk. Unlike most other classes they will not share any attack animations with another class, making their fighting style look quite unique.

Scenarios and Challenge Modes

Blizzard has been a little tight-lipped about its new modes leading up to this event, but we've got a whole lot of new information.

Scenarios will be implemented in Mists of Pandaria, and will essentially replace group quests completely. Dave Kosak, Lead Quest Designer, said "We realised players were hitting a wall with group quests and possibly never returning to complete that chain." Existing group quests will remain in the game from launch and previous expansions, there will be no new group quests; instead they will be Scenarios.

The new Scenarios will be offered to players as part of quest lines, but you'll be able to queue for them as you would a random dungeon. The good news is they won't require a traditional dungeon group set-up of tank, healer and DPS, so the developers predict that queues will be very short – as an added bonus Scenarios will also scale, to a certain extent, based on the make-up of the group, so an all-DPS group will provide a very different experience to a tank/healer or traditional three-role party.

Challenge Modes are designed to offer level 90 characters a competitive PvE gaming option without raiding. By completing Heroic dungeons within specific time frames, players will be awarded Bronze, Silver or Gold medals. Bronze will award achievements and titles; Silver awards unique armour sets with unique animations; while Gold awards a unique mount. These timed trials are designed to be gruelling tests of a team's coordination and skill, but players won't be able to game the system by using Tier weapons or armour. The Challenge Mode dungeons will cap the team's item level, ensuring that players won't be able to overpower the mobs in the dungeon.

To keep Gold level players invested, there'll be a leader board where players can track the accomplishments of specific groups. The leader board will also record the class/role breakdown of groups as well as the best time trial results.

Battlegrounds

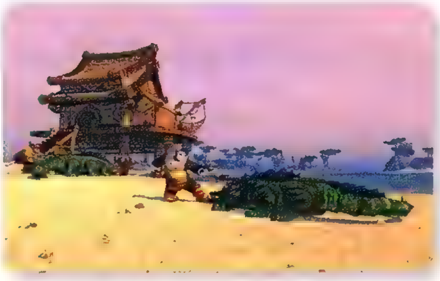
Fans of Warcraft's PvP will be able to play some new battlegrounds, which utilise unique mechanics to spice up the game.

The Ancient Mogu Temple includes a portable resource called the Ancient Mogu Artefact. The artefact provides a damage buff, but it also inflicts a debuff that damages the player holding it and reduces their healing taken. Keeping hold of it will earn you points, more or less, depending on how close you are to the centre courtyard, but it will need to be passed around cooperatively in order for players to get the benefit without killing themselves off. Lead Content Designer Corey Stockton described the game as "very fast paced and exciting."

Back in the old world, players will be able to enter battle in the Silver Shard Mine, situated under Stranglethorn Vale. Mine cars inside the mine act as moving capture points, running along rails – players must capture them before they get to the depot, however opposing teams can manipulate the rail tracks, forcing the cart to take longer routes to the depot, and the opposing team can attempt to take control.

Talent System overhaul

This isn't the first time that Blizzard has overhauled the Talent system, and surely it won't be the last. This is, however, the most complete change to the existing system since the game launched. Blizzard developers have repeatedly stated they feel the talent system is bloated, and that the current system forces players to choose the "correct spec."



Playing with premade level 85 characters in the new zones with well-known specs, we didn't feel the lack of a 'full' talent tree. Important class-specific abilities – those abilities that had traditionally bloated out the talent trees – have been moved into a new Passive ability group, and players will still access class-specific skills as they level up. At levels 15, 30, 45, 60, 75 and 90, players will have the option of choosing one of three Talent options. Each option should provide players a different flavour of play-style – for example a level 15 Warrior can chose one of three movement-based talents; Charge, Double Time or Warbringer. We experimented with melee and ranged classes with the new talent builds and there wasn't any sense of class strengths being reduced or missing abilities.

Dungeons and Raids

Although the developers are still keeping quiet about the nature of raids in Mists, we can reveal that there will be three raids available when the game ships, and each will be available in 10 and 25, normal and heroic versions, as well as the Raid Finder 25-man.

There will also be a total of nine level 90 Heroic dungeons. Three of those will be revamped dungeons from the classic game; two from the Scarlet Monastery and Scholomance. The revamped dungeons are controversial for some players, who might prefer completely new content. However, we have fond memories of Scholomance and would love the opportunity to experience it again. We can expect a complete redesign inside, including a rearrangement of interior rooms – no more skipping that first hall!

One of the new dungeons is the Stormstout Brewery, both a quest hub and dungeon, but its footprint extends out into the world, making it a location for questing and scenarios as well as dungeon bashing.

And that's a wrap

So that's Mists of Pandaria in a fairly large nutshell. Although Blizzard is playing its cards close to its chest (as usual) as far as an official release date is concerned, our experience of the new 1-10 zone and 85 levelling zones suggest that the game is close to ready for open beta. In fact when describing the new zones, Lead Quest Designer Dave Kosak said they were mostly complete, barring The Dread Wastes, Vale of Eternal Blossoms and Townlong Steppes. At a guess we'd have to say that beta will be playable in the next month or so with a release date after mid-year. But don't hold us to it!

New threats

The Mogu

The Mogu are an ancient boar-like humanoid race, and were once the overlords of the Pandaren and all of Pandaria. In the Krassarang Wilds players will encounter the remnants of this ancient empire, living among the ruins of their cities. In the wake of the Cataclysm they are trying to take back their ancestral lands. The Mogu claimed control through cruel domination of the other races and, as masters of flesh-shaping magic, created slave species such as the lizard-like Saurok to do their dirty work. In the wake of the Mogu Empire's collapse the Saurok roam the land as bandits and thieves.

Throughout Pandaria we'll be introduced to other NPC races, such as the amphibian Jinyu, allies to the Alliance and the monkey-like Hozen, who link up with the Horde.

In the shadow of Kun-Lai Summit on the Townlong Steppes players will meet the Youngol; another branch of the Tauren family tree, who have evolved slightly differently to their Kalimdor cousins, since their separation during the Sundering.

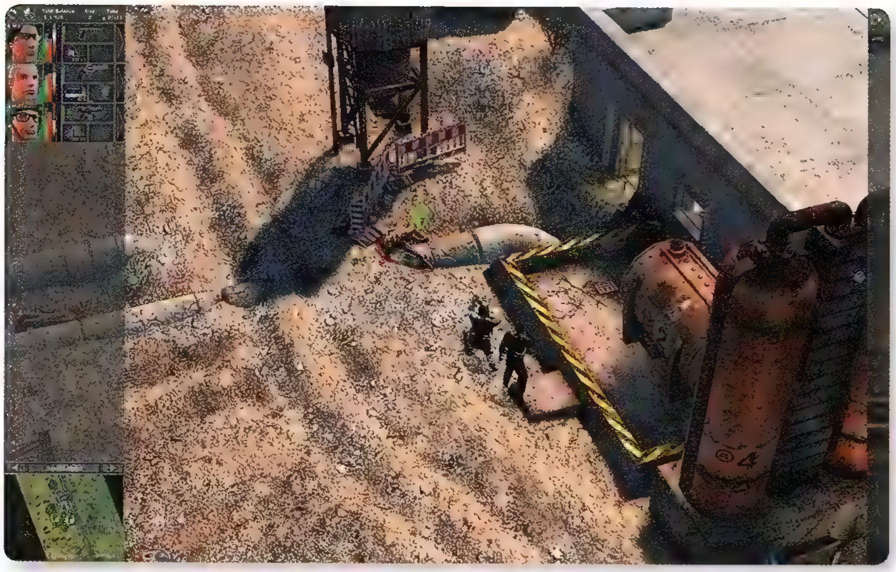
And finally, on the slopes of Kun-Lai are the diminutive Grummle – the Sherpas of Pandaria – cute little things that they are.

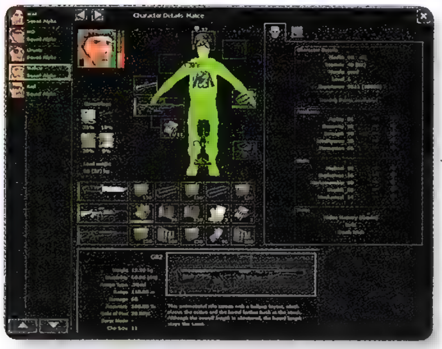
The Mantid

An ancient and highly evolved insectoid race; although, unlike the Sithilid, there is no hive mind. The Great Wall at one end of the Vale of Eternal Blossoms was built to protect the Mogu Empire from the waves of hungry Mantid young that swarmed towards it every year.

The Sha

Unique to the realm of Pandaria, the Sha are the concentrated energy of negative emotions, such as doubt, fear, anger, hatred or despair. Mortals can become possessed by the Sha and become the embodiments of these emotions. The Sha of Doubt was imprisoned within The Temple of the Jade Serpent by the last emperor. Unsurprisingly, the advent of the Horde-Alliance war causes all sorts of problems where the Sha are concerned.





Jagged Alliance: Back In Action

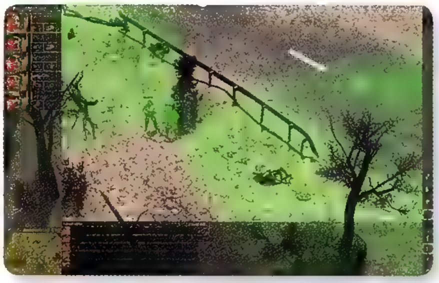
Back In Action, or Put Out To Pasture?

Hollywood has a thing for re-inventing old movies, and the trend seems to be progressing to games too – the original Jagged Alliance and Jagged Alliance 2 are classics that well and truly have earned their place in the *Greatest Games Evar* hall of fame, although if you played them today you'd likely barf up last night's burger at the graphics.

Which is where JA:BIA comes in. Re-invented for modern PCs by German developer Coreplay, Back In Action is quite literally the same game – same plot to over throw the dictator, same entertaining voice-acted mercenaries, same exotic third-world country of Arulco – only on a newer engine that gives the JA universe a chance to shine.

But as fans of the original series, we're in two minds about BIA. On the one hand, its nouveau engine brings us JA like we've never seen it before, with higher resolution graphics combined with physics ragdolls – so you can see your enemies die in spectacular ways that the original games couldn't offer.

But, perhaps because Coreplay isn't a powerhouse development team, some of the gems that made JA so amazing have been left out. A lack of development time? Who knows, but while some recent patches have attempted to redress the issues, it still lacks a certain... personality.



To its credit, BIA adds a new system called Plan-and-Go, which is a fancy way of saying they've managed to mix turn-based and real-time play into one seamless engine. And it does actually do it really well, letting you watch fire-fights play out in real time, pausing only when you need to issue more orders, and then let the action fly again. Big fights are fast and frantic, and are a joy to play.

Also honoured well are the merc's dialogue – hearing them boast skill shots, cry out in pain when wounded, or simply finding shiny items; each has their own unique personality.

In the what-were-they-thinking camp there is the omission of I.M.P (Institute for Mercenary Profiling), the system in Jagged Alliance that allowed you to design your own merc, your own avatar in the game, to play alongside your A-Team of mercs.

Then there's the character portraits. In the original games these were brilliant artwork, and while in BIA Coreplay has attempted to modernise them by making them animated 3D models, the effect is appalling. Most of the faces look like plastic mannequins, and are too similar to really show any individuality.

And then there's the little annoying things that all add up – having a merc blocked by basic obstacles like a road barrier that's half their height (mercs can't jump?); explosives that can only be used in set locations; levelling no longer being use-based and instead following the RPG model of allocating points at a level up (which makes little sense); boring dialogue choices that have no bearing on the outcome of a conversation; no fog of war so you always know where enemies are, and finally no auto-looting a map at the end of battle like the original games had – requiring you to visit every container before you leave just to make sure you've haven't missed anything. Sometimes doing this takes longer than the actual fighting! It's exceptionally tedious.

So does JA:BIA live up to its heritage? Unfortunately, no. But on the flipside, it is still a fun game to play and has enough of the core JA experience to keep you going. Modernising with a new engine and Plan-and-Go system are what save this sequel, and at $40 (on Steam, at least) it's priced about right for what you get. **AM**

PC

Developer Coreplay
Publisher Kalypso Media
Website www.jaggedalliance.com

Gameplay The core elements are there, but where's the rest?	73
Graphics High-res tile-based glory, but the avatars suck.	78
Sound Voice acting enjoyable, weak sound effects.	69

Overall
JA:BIA could have been so much more than it is.

73%

Combat Mission: Battle for Normandy

Only serious warnerds need apply to this accurate, but demanding game.

When the original Combat Mission: Beyond Overlord was released in 2000, it was a revelation. There had been serious WW2 strategy games before – including the classic Close Combat, which is where CM's creator cut his gaming teeth, and other, more detailed boardgame simulations – but no other game before had ever captured such detail of the period in 1944, combined with a great looking game engine. It could even be argued that no other game has done it since – until the latest game in the series, subtitled Battle for Normandy.

Normandy marks a fond return to the period that gave indie publisher Battlefront its start, after a foray into modern combat with Combat Mission: Shockforce. Shockforce left us a little cold – there's something about modern combat which, to our mind, doesn't quite suit the way Battlefront makes games. But for WW2... there's almost no better simulation of it on the market.

Taking turns

If you're unfamiliar with the series, the main conceit is in its turn structure. There is, for the first time, an option to play in real-time, but the classic mode of the game is a combination of turn-based decision making, and real-time segments where you effectively sit back and watch your orders carried out. The beauty of this method is that the opponent – whether live or AI – does the same. What you end up with is a beautiful feeling of your plans working or failing as your units contact the enemy, and your units respond to whatever they encounter. This mechanic also makes old school modes of play like Hot Seat, and even Play-by-email is easy.

The core action of any game takes place in full 3D, though it needs to be said that good graphics are not the focus of the game. Battle for Normandy is the first Combat Mission game to use the second gen 'CMx2' engine, but at first sight you could be forgiven for thinking this game isn't much newer than the original. Ground textures are plain at best, buildings blocky and unappealing, while units often seem to hover or float on the landscape. Those units, at least, look better than ever, and armoured vehicles in particular look fantastic.

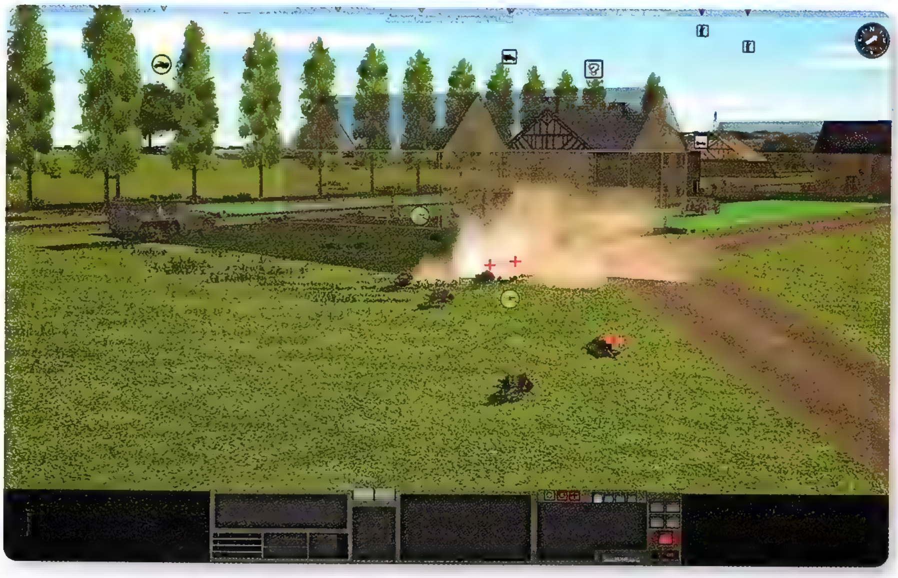
It might sound like an indictment of the game to point these things out, but it's important to focus on what Battlefront does very well – simulate and recreate all the facets of tactical warfare in the period. To that end, this game isn't just about moving units and getting there first with the most guns – though that often helps. Rather, it focuses in on unit morale and the importance of timing in just about all engagements.

Run away!

Command and control of units in this game is important. Squads left out in the middle of nowhere, without support from officers or other units, will be very prone to break and run at the first sign of casualties, effectively taking those

units out of your control. Take that same squad, and place it nearby its command section, with other units like machine guns or the rest of its platoon flanking it, and it'll fight far more effectively. The psychology and morale of a unit also feeds into everything else it can do, and the interlocking nature of units in Combat Mission mean that there's very rarely such a thing as expendable cannon fodder.

Keeping your units under control is one thing – the other challenge is making sure they work together, especially when it comes to things like the timing of bombardments or springing of all-important ambushes. In the former case, even artillery under your direct command, like mortars, take time to be dialled in, so you need to think ahead of time to use them effectively. In the latter, because you're not directly controlling individual units (in the turn-based mode), you'll need to position units and order attacks with the understanding that, to be effective, every unit must act as a whole. The sense of actually being in command of living, breathing soldiers is second to none.



The orders you can give units are suitably detailed. Movement orders, even for a simple infantry squad, include four speeds and modes, each with their own advantages and disadvantages. You can order units to only go after light targets, to dig in or hide, face a certain direction, mount up into transports, or deploy onto particular floors of a building.

If it could be found on a battlefield in France in 1944, you can find it in the game, from trucks and towing vehicles all the way up to tanks.

Combat Mission's a game about details, and there's no area of the game more detailed than the ballistics, especially when it comes to armoured combat. If it could be found on a battlefield in France in 1944, you can find it in the game, from trucks and towing vehicles all the way up to tanks, and the damage these vehicles can receive – and dish out – is based on studious research into actual studies made back in the 40s and 50s. You can watch a tank fire its main gun and hit another tank, and know that there's a mess of calculations going on. Accuracy is based on crew skill, the sights being used in a particular vehicle, speed, terrain and conditions. Penetration – assuming you hit, of course – is calculated by comparing angle of shot, thickness and angle of armour, where the particular vehicle was hit, and more. The results are hyper-detailed; you can get ricochets (which end up landing somewhere, possibly violently), spalling of interior armour, crew injuries, stuck turrets... the list goes on.

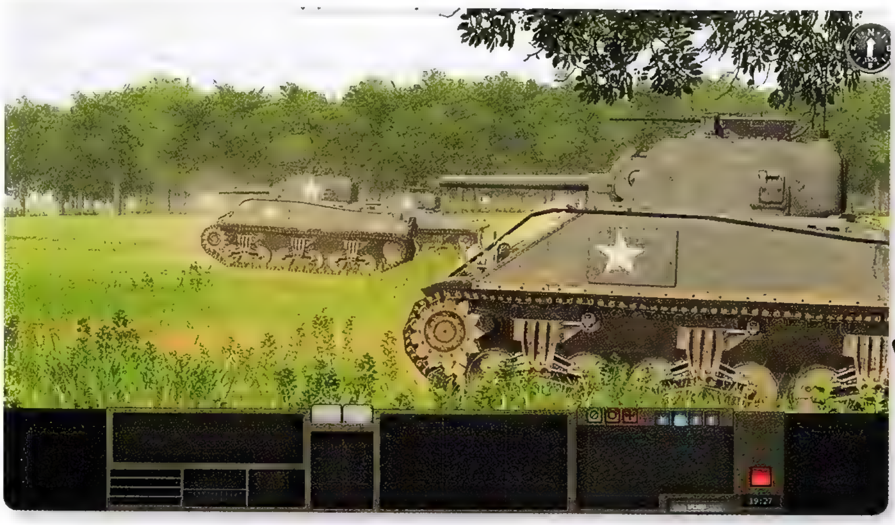
The really wonderful thing about the game, though, is that detailed as it is, you can still have relatively huge engagements, right up to battalion level or higher, with every tank, soldier and truck on the battlefield – grognard nirvana.

Camera not so lucida

We can forgive the game's relatively poor graphics, because they're really not the focus – if we want eye-candy we'll fire up Battlefield 3 or Total War. But one thing that does make the game more of a chore than it needs to be is a very sticky camera system. Battle for Normandy uses a combination of mouse and keyboard control, but keyboard movements are sluggish at best, and downright unresponsive at worst. It makes the game almost unplayable in real-time, though it's less impactful when turn-based.

It's not a game-breaker, though, so if you're looking for a WW2 wargame that's rich in detail and scope, Battle for Normandy's got you covered. With a range of single battles, campaigns, multiplayer modes, and even a strong map and scenario editor, it's easy to lose yourself.

You have been warned, soldier. **DH**



PC

Developer Battlefront
Publisher Battlefront
Website www.battlefront.com/

Gameplay	Rich and absorbing, let down only by the camera.	89
Graphics	Workmanlike at best, but functional.	60
Sound	Great weapon effects, turn off the music.	78

Overall
One for the serious wargamers.

83%

Asura's Wrath

An overfull tank of rage-a-hol.

We were excited when we first heard of Asura's Wrath, and the various news floating about at e3 painted a picture of a very unique game from a well-known publisher. Though you may be familiar with Capcom, developer CyberConnect2 is not so universal. That is, unless you play Naruto games. However, its managed to deliver on initial impressions with a quirky title that does things very differently – though it is important to note that differently does not always translate to 'better'. Amusingly, we received a printed copy of Rage: A Step-by-Step Guide to Overcoming Explosive Anger alongside Asura's Wrath for 360, a cheeky throw-in from local Capcom PR.

U mad?

Asura is a pretty typical character from the pages of Japanese Manga, translated into Anime form for the game. He enjoys status as a demigod, imbued with the usual bevvy of powers such as immortality and strength, and notably, he grows an extra four arms when particularly annoyed. Why more arms? Because more arms equals more punching.

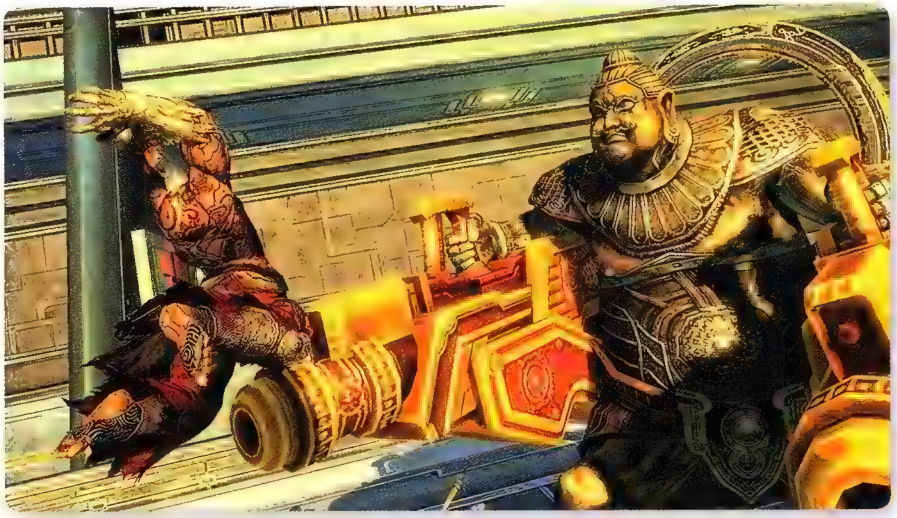
He's joined by seven other demigods that are unified underneath a generic Emperor, and they work together to protect the planet of Shinkoku against the demonic forces of the Gohma. This is all explained, more or less, in the opening scenes of the game, as the planet is surrounded by a fleet of such a ridiculous size that it could only come from Japan. The fleet, strangely, originated from the planet itself, and is mobilised against the Gohma that are appearing from the planet's surface – this is not really explained, but the official line probably sounds similar to "hey, big ships in space, shh, it's cool okay."

We're given control of Asura as he flies through space towards the planet, destroying the fish-like Gohma carriers that pour out of the planet by flinging his fists towards them, causing energy to shoot out and destroy them. Suddenly, a gigantic Gohma named Vlitra appears after a giant space laser is fired from a giant space statue in space, and Asura whips out his extra arms to punch it to death. In space. This is achieved by the use of quick-time events, which involve the mashing of specific buttons as displayed on-screen, or the flicking of analogue sticks in the appropriate direction. It takes a while to get used to these as the action is quite frenetically paced, and they're pretty distracting.

Eventually the giant Gohma is subdued, and thus ends the first episode of part 1. Then the worst storytelling technique we've experienced in years kicks in.

Before the fact

The links to Anime run deeply, and of the ten episodes that make up each part, each begins with a pre-rendered video. These videos are baffling, leaping forwards and backwards chronologically, and they even go so far as to explain what happens in the next episode *before*



you get to play it! Accompanied by a horrendous voice-over, they rip you rudely out of the game and spoil it mercilessly. These can be skipped with the Back button, but you have to be quick to mash it before a major plot point is revealed. We get that Anime is cool, and that some video games have attempted to try to be an interactive movie, but an interactive Anime series just doesn't work convincingly. CyberConnect2 have even gone so far as to include mood-breaking "To be continued" stills in the middle of each episode, halting story progression and cutting any suitably epic music short. And in typical Anime style, the dialogue at the end of each episode is repeated at the start of each new one – and is staunchly unskippable. Combined with downright confusing dialogue and a penchant to leave things unanswered, you'll have to let go of any attempt to follow the story and just go with the flow.

Weird storytelling methods aside, it eventually transpires that Asura is framed for the murder of the Emperor by the leader of the eight Guardian Generals, his daughter is kidnapped and held prisoner because she's great at channelling Mantra (energy that demigods can manipulate to boost their powers), and Asura is effectively killed, sending him tumbling to Naraka.

War is Naraka

The Buddhist version of the Underworld is where Asura finds himself for a period of 12,000 years. He eventually makes it back to the real world, but it's hard to feel like you've achieved very much as a player – the vast majority of the game is cut-scene, with the odd quick-time event thrown in. The remainder is quite standard fighting game, where a variety of punches and punching styles mesh with fists and more punching. Enemies appear in the form of animals such as gorillas, turtles and elephants, black-skinned with red veins, though they're mostly a chore to defeat. Fighting is reminiscent of X-Men Origins: Wolverine, just not as fun.

Asura's old buddies, the seven demigods, have declared themselves as the Seven Deities in Asura's absence, and Asura fights them in sequences that are the most interesting combat the game has to offer. From fighting the fat Wyden, who uses Mantra to inflate to the size of a planet, then attempts to crush Asura with a gigantic finger (red-hot from re-entry), to the fast-moving Yasha who proves very difficult to best – especially since Asura is literally disarmed at the time – these are fresh and interesting in a way that Shadow of the Colossus was at launch.

Unfortunately, these epic fights are so padded by a huge amount of cut-scene and average group fights against Gohma, that they aren't really worthwhile slogging through to reach. If you enjoy the visual style of the game – and really, Unreal Engine 3 cel-shaded with interesting character design is quite nice to look at – then it might be worth sitting through to the end. If you're a huge Anime buff and really love the disjointed story (somewhat reminiscent of The Melancholy of Haruhi Suzumiya, which personally annoyed the hell out of me), then it might be worth a go.

For everyone else, Asura's Wrath is a game that attempts to take interactive storytelling to a new level, but fails spectacularly to capture our interest. At standard retail pricing, it's also not stellar value; you probably won't want to sit through a second time, and there's little in the way of additional content. Though there is DLC coming in the form of a Street Fighter crossover, it doesn't look like it'll give Asura's Wrath the legs it needs to be a truly great game.

One to avoid. **JR**

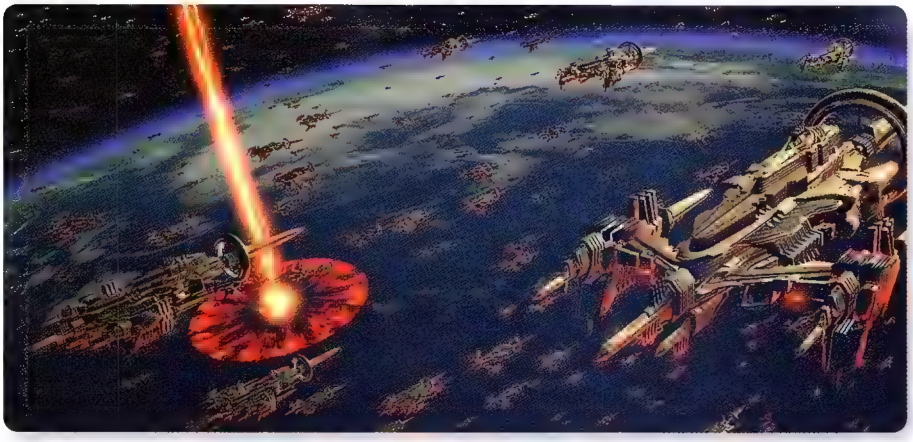
PS3, 360 (Played on 360)

Developer CyberConnect2
Publisher Capcom
Website www.capcom-unity.com/asuras_wrath

Gameplay Confusing, little fighting, quick-time with low replay value.	40
Graphics Colourful and interesting, nice for console.	90
Sound It's okay, though English voice-acting is painful at times.	75

Overall
Asura's Wrath is more likely to make you angry than provide a great experience.

63%



Mass Effect 3

The epic sci-fi trilogy is over – does it go out with a bang, or a whimper?

It's entirely possible that there's no way for a fan of Mass Effect – and I most definitely am – to pull back from the series now that it's over and be really and truly objective when it comes to rating the series. Personally, I think that's true of just about any game, but BioWare's cleverness with giving players choice, and letting those choices have impact on the game world, whether an illusion or not, makes it even tougher. In a lot of ways, the game I played is very different, emotionally and thematically, to the game that anyone else plays.

How do you rate something like that? BioWare's made it even more challenging by ending the game on such an epic note that it almost feels like it's thumbing its nose at all those apparent choices. In all honesty, now that I've finished Mass Effect, good or bad, I'm going to be thinking about that ending – and my role in it – for some time to come.

That said, let's see if we can find some fitting way to summarise this, the last of an amazing series of games.

Pathos, damn pathos

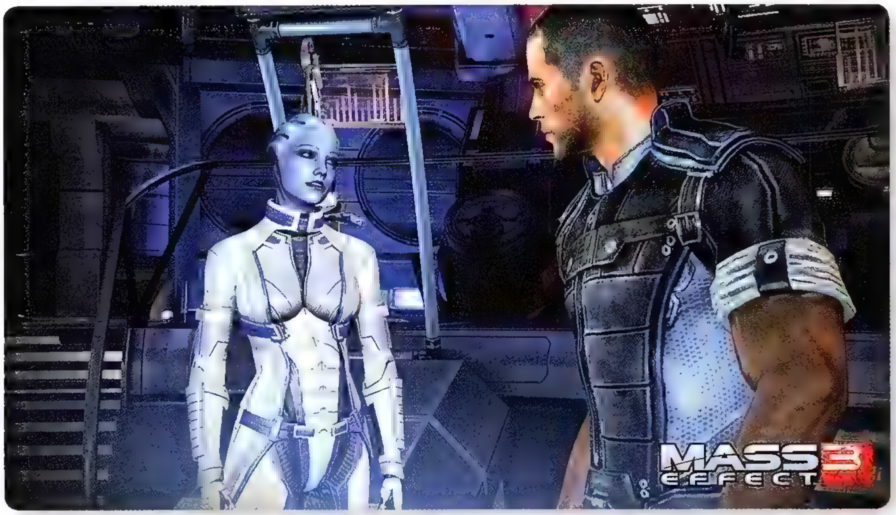
If the first game was a rip-roaring space opera adventure, and the second a grittier meditation on the sacrifices we make to get things done, it appears the third instalment is aiming for an altogether more elegiac sense of place, one that possibly doesn't fit in with the overall arc of the game itself. Nowhere is this more apparent than in the game's opening, where our hero, Shepard, must get off Earth after the Reapers cut through its defences like a hot dreadnought through butter. During the fight, Shepard finds, and cannot save, a young child; we get that war is all hell, but the recurring motif of this kid through the game is probably the weakest part of Mass Effect 3. It's also the first hint that BioWare might be trying to tell us something about choices, and our seeming lack of them.

It's hard to go much deeper on that point without getting into serious spoiler territory, as the ending is so very tied up with that opening scene. It's a handy framing device, but like the scenes that bookend Saving Private Ryan – which are similarly mawkish and unnecessary – they feel like they hinder more than help the game.

It's a shame, too, because if you do ignore those moments of extreme pathos, the game is easily one of the best RPGs you'll play today – and dammit, it's definitely more RPG than shooter, despite what BioWare says – especially if you have been bringing your save games along from each previous title.

To X, or not to X...

Creating a game with a rich array of main objective quests and lots of side quests is always a challenge when you're also trying to maintain a sense of pace and urgency in the ongoing plot. On the one hand, you want players to feel like they can go anywhere and do anything in



their own time; but on the other, you'll also have a plot which is all about saving the world before the big bad chews it into crunchy chunks. Mass Effect 2 dealt deftly with the problem, by not letting you see the main plot until you'd gotten a certain way into the game, and then hammering you with consequences if you rushed in early – like having half your crew killed. Mass Effect 3 follows a similar one-two set-up: you're out in the wide galaxy mustering allies for the big fight against the life-destroying reapers, but BioWare's placed a trigger on the events that lead into the end-game. It's pretty clear when that happens, too, and you can easily justify holding off on making your big attack if you think you need more time. It's a testament to the writers' skill that I rarely thought about the end-game in pure gaming terms; there's an admirable level of deep immersion to be found all through the game, whether you're playing politics with counsellors on The Citadel or blasting seven kinds of crap out of bug-eyed aliens.

Even better, BioWare's introduced a handful of time-sensitive missions into the game. Trust me, when your comms officer tells you that the Academy you had to go save from the Reapers has been over run, but hey, you had more important things to do and they were only students anyway, you'll feel a kick to the gut. More importantly, as your mission log steadily fills up, it makes you feel that your choices of whether to attack that facility, or recover that artefact, or rescue those scientists, are all fraught with peril.

Beneath all of the running around, there's a couple of important new mechanics to Mass Effect 3. You're fighting the biggest war the galaxy has ever seen, and your success in getting allies on-side is reflecting by your War Assets rating. Each faction, and the units they bring to the table, adds points to this score, reflecting just how big a fleet/army you have on hand. It's actually very satisfying to see what units and squadrons you have on standby with each successful mission or negotiation. This score is further affected by the overall Galactic Readiness Rating, which is influenced by things like the tie-in iOS game infiltrator, and Mass Effect 3's own co-up multiplayer (which is a lot of fun, by the way, but not something you'll likely play much beyond finishing the game itself). This score is a percentage that modifies your War Assets. You can safely ignore this metric if you want, but then you'll just have to work harder in the singleplayer. Overall, it's actually a very elegant mechanic.

Once again, the game's inventory system has

It's a testament to the writers' skill that I rarely thought about the end-game in pure gaming terms; there's an admirable level of immersion.

changed. It's still not the traditional model, but there's much more detail than in Mass Effect 2. You can upgrade armour parts to boost stats and abilities, equip a range of weapons as you find them in your adventures, and similarly upgrade them, too. It's still the most RPG-like part of the game, but on the upside, the dialogue and plot choices you'll face are among the most satisfying you'll encounter in any game. As you struggle to unite the galaxy, there are some very tough decisions to make on who lives – and who goes extinct.

A tough ask

Maybe we're holding the rest of the series in too high regard, but it has to be said that this is possibly the weakest of the three games in terms of technical execution. The animations of bodies in motion seemed haphazard at best, and downright freakish in many extremes, and lots of otherwise impactful dialogues are marred by camera eccentricities or apparent broken necks on the models. We also failed to import our Shep's face into the game, and couldn't quite get the reconstruction just right. It may sound odd, but this was hugely distracting for the first part of the game, and really disappointing.

Similarly, some of that dialogue seems a bit... flatter than in previous games. Possibly the voice talent were a bit rushed to work through all the eventualities of the previous games, but it's definitely not on par. And, as usual, the summarised labels for each dialogue option are sometimes too vague to understand what you actually end up saying or doing. There's nothing worse than accidentally shooting someone when all you wanted to do was get angry. Oh, okay, maybe there is – having your ending bugged so you miss out on the satisfying bits. Yeah.

At least load times were almost non-existent, and while the character textures can be criminally muddy, the Normandy itself has never looked better.

But perhaps the big take away from this last game is that, while BioWare can make some great set-piece action scenes, by and large they've got no business working on a shooter. At its best, the combat in Mass Effect 3 is tense affair, as you struggle to defend comrades, recover lost artifacts and generally fight a goddamn war. At its worst, though, it's one over-powered boss after another, as you're forced to run back and forth between the fight and whatever nearby source of ammo and healthpacks you can find; it's not epic, it's annoying, especially as the game ramps up end-game difficulty by simply adding more bosses at once. This frenetic sense of managing resources rather than kicking alien butt is made even worse by the horrendous cover/sprinting controls, which share the one button. After the last few fights I was ready to think about turning combat off entirely if ever I replay the game.

As to the ending, I won't spoil, but it is oddly flat. It's downbeat, but also just... odd. I was expecting more closure, and I will admit that I feel a bit disappointed. Then again, it's the ending that has really got me thinking about this game, more than just about anything else I've played in recent years, save perhaps Halo: Reach.

Endings

I think I will always consider Mass Effect, as a whole, to be one of the seminal experiences of my gaming life. I'd rather have it, flawed as it may be, than not have it at all, and Commander Shepard and his crew stand tall in my own personal heroic pantheon. But it also seems clear that, in the end, BioWare's ambition has exceeded its grasp; Mass Effect is simply not as strong a game as could be hoped. Sure, it plays to all of the company's many strengths, but, sadly, also shows up more than a few of its weaknesses, never more so in the way the game ends on a high emotional note, and then immediately tells you to look forward to the DLC.

Really? Did we need that sales pitch as our last memory? Apparently so... **DH**

PC, 360, PS3 (reviewed on PC)

Developer Bioware
Publisher Electronic Arts
Website http://masseffect.com

Gameplay 84
At times transcendently good, but often frustrating.

Graphics 89
It certainly looks good, despite some weak textures.

Sound 80
Some hurried voicework, but excellent music and audio otherwise.

Overall 86%
A very good game, but tragically flawed in parts.

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PS Vita

Sony's latest hand-held is a technological wonder, but its success hinges on dev support.

Sony's follow-up portable games console comes some seven years after the launch of the original PSP. A lot has changed in those seven years – most significantly the rise of cheap, accessible mobile gaming. In this environment, it's easy to question whether people want or need a console experience in the palm of their hand, and whether they will be prepared to pay a premium for this privilege. It's almost like Sony has launched a brilliant answer to a question not a lot of people asked. This is really the key factor in determining if the Vita is for you. Sure, it goes closer to emulating the home console environment than any handheld previously, but a lot of people don't want that. They have their home consoles and PCs for that, and gaming out and about is more suited to bite-sized entertainment rather than epic gaming sessions. However, we feel that there definitely can be a place for the Vita in our life, as its dedicated controls and technology offer something that smartphones can't match.

The Hardware

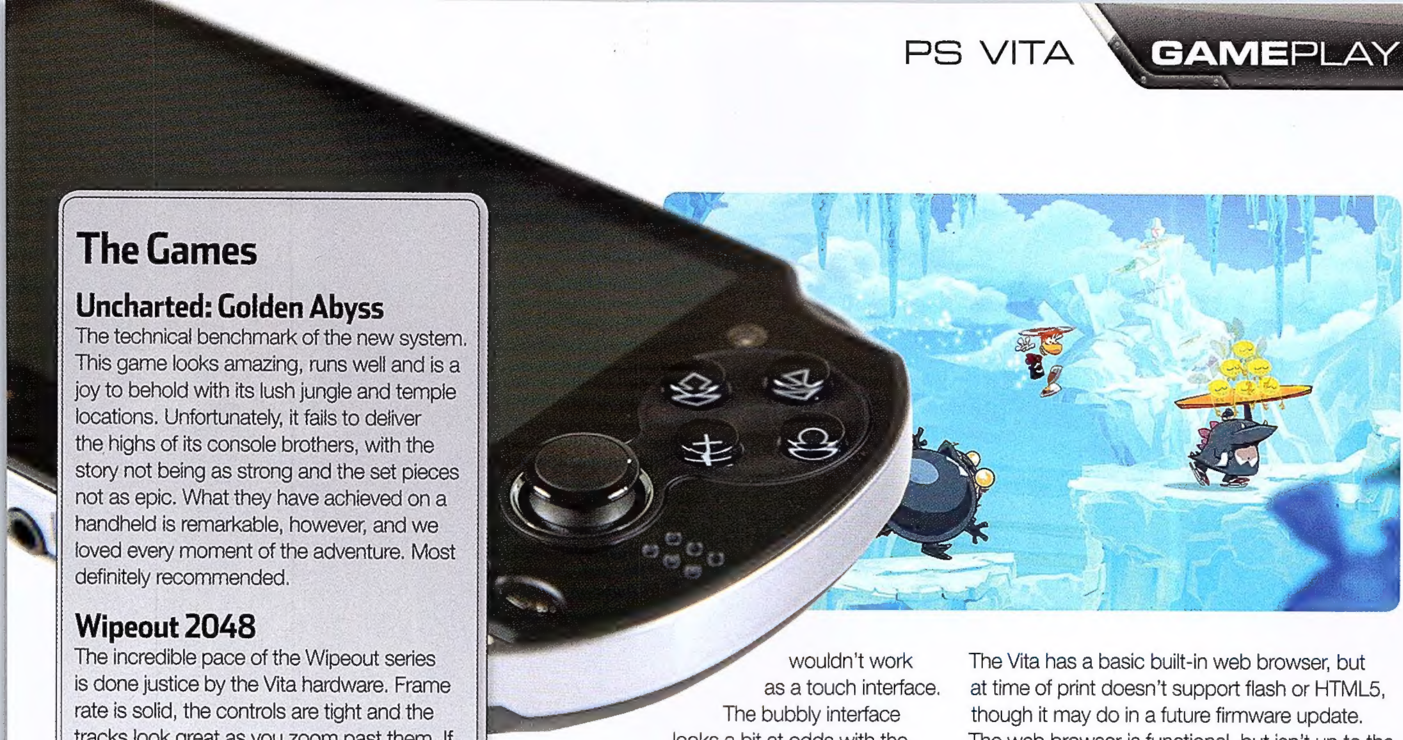
Questions of the Vita's place in the market aside, as a hardware device it is an undoubted success. The console is larger than the PSP, but doesn't feel unwieldy. We have relatively large hands and noticed no discomfort using the device. It looks good, feels like a premium product, and is extremely well made. The star of the show is the five inch OLED screen. The screen looks magnificent and displays games and movies with wonderful clarity with its 960 x 544 (qHD) resolution. This is made possible by the impressive quad-core PowerVR graphics processor, coupled with an ARM Coretex-A9 CPU, which is a more powerful version of the same chips found in devices such as the iPad 2. All this grunt will sap away the Vita's battery after about 4-5 hours of gaming.

The screen looks magnificent and displays games and movies with wonderful clarity.

The Vita has a myriad of new input possibilities, most prominent being the dual analogue sticks that so many people have been calling for since the PSP. They are relatively small, but achieve their aim of bringing home console style control to the portable arena. Sony has also included a touch screen on the back as well as a regular front touch panel. The front touch screen is quick and responsive, and while the rear panel feels awkward at first, it is an interesting inclusion and if utilised properly should open up game play mechanics that aren't possible on other devices. Rounding out the control methods is a sixaxis motion sensing system similar to the dual shock PS3 controllers so you can get your waggle on. There are also front and rear cameras, but these are only useful for augmented reality gaming given their poor quality.

The Software

Gone is the XMB found on the PS3 and PSP, replaced with an iOS-like set of icons and a much more bright and bubbly feel (along with some ultra annoying menu music). We assume a major reason for this is that the XMB simply



The Games

Uncharted: Golden Abyss

The technical benchmark of the new system. This game looks amazing, runs well and is a joy to behold with its lush jungle and temple locations. Unfortunately, it fails to deliver the highs of its console brothers, with the story not being as strong and the set pieces not as epic. What they have achieved on a handheld is remarkable, however, and we loved every moment of the adventure. Most definitely recommended.

Wipeout 2048

The incredible pace of the Wipeout series is done justice by the Vita hardware. Frame rate is solid, the controls are tight and the tracks look great as you zoom past them. If you're new to the Wipeout series the game is a wonderful introduction, but if you're a veteran of the series, this doesn't really offer anything significantly new, though it is in a much more beautiful package this time around and looks fantastic.

Rayman Origins

Our pick for the best-looking launch title. The 2D art style is wonderfully refreshing and really pops off the Vita's screen. The game is extremely charming and the platforming takes us back to the pure old days of side scrolling platformers. This is a port of the console version with the multiplayer dropped off. It is an impressive and faithful port, and the game is perfectly suited for handheld play while on the go.

Unit 13

Made by the people that brought you SOCOM, Unit 13 is a similarly styled third-person military shooter. The story is relatively non-existent, but the game serves up bite sized missions that are heavily point-based, and rewards finishing levels with style. Score and multipliers go up the more headshots you accumulate, the less you are seen, and how thoroughly you complete the mission objectives. This adds a lot of replay value as you try and improve your scores to climb up the leader boards.

wouldn't work as a touch interface. The bubbly interface looks a bit at odds with the sleek, dark looks of the console itself, but is very functional and easy to use. Pressing the PlayStation button within a game will take you back to the main interface, and will save the state of the game so you can pick it up exactly where you left; off days later if you so choose. This is a great feature and lends itself well to short gaming sessions.

The 25 game lineup is very strong for a launch, and offers a decent intro into the capabilities of the system. Sony just needs to ensure there is no lull in developer support like there arguably was for the PSP. Games such as Uncharted and Wipeout already show what a powerhouse device this is, and things will only improve once developers come to terms with the hardware at their disposal. As well as the Vita games, a vast number of PSP titles are backwards compatible with more promised by Sony. PSP titles are up-scaled to fit the higher resolution of the Vita, taking advantage of the extra speed, and you can enable a bilinear filtering option to smooth out edges. This works well for 3D games but less so for 2D games as it affects edge definition. A great inclusion is the option to remap buttons to the second analogue stick, useful for games such as Resistance: Retribution, which uses the face buttons for camera movement.

Wireless and/or 3G

The Vita is available in a wifi only version as well as a wifi/3g version, with Vodafone as the 3G partner. We don't think the price-premium for the 3G version is worth it, especially given that a vast majority of smart phones can act as portable hotspots for your data on the move.

The Vita has a basic built-in web browser, but at time of print doesn't support flash or HTML5, though it may do in a future firmware update. The web browser is functional, but isn't up to the browsing experience offered by your average smartphone. Media playback is unsurprisingly solid given the quality of the screen.

A significant issue that holds the Vita back is odd pricing decisions. The EU store to which Australia connects has some very poor pricing, such as the port of iOS game Dungeon Alliance at $47.95 when it can be had for 99c on the App store. Games like FIFA cost more through the online store than buying a physical copy, despite promises that the opposite would be true. It's worth noting that the US store is significantly cheaper by almost half than the AU store. Not happy. However, there are some great cheaper games on the store such as Super Stardust and Motorstorm RC which can both be had for $13 and $10 respectively, and show the path that publishers should be taking with the device. This is obviously a publisher issue, but we'd like to see Sony actively pushing for better pricing.

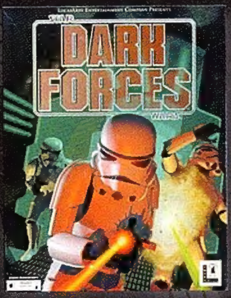
The Vita carries no internal storage and even some cart-based games require a memory card in order to save. Retail pricing for the cards starts at around $30 for the 4GB card and up to $70 for the 16GB. These prices are ridiculous given the equivalent pricing of microSD cards. With games like Uncharted clocking in at over 3GB, it's going to get expensive managing a sizeable catalogue of games if you choose to go digital.

Sony has hit the mark with the Vita hardware, however the real question will be whether enough people agree with us to support the thing, ensuring ongoing developer support so the machine can reach its dizzying potential. **DW**

Overall

A brilliant piece of hardware that is an extremely strong proposition for gamers.

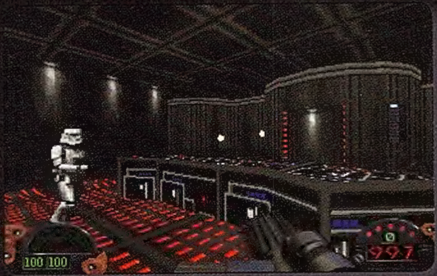
91%



A long time ago

In the immortal words of Kyle Kataarn...

I have a good mate that I've known for two decades. We used to be flatmates; we'd game together – on computer and tabletop – and of course, watch Star Wars together. We're still close friends, and we more or less have our own shorthand language; little phrases that are apparently without meaning or context to anyone but us. Most folks find it kind of infuriating, and, honestly, I can't blame them. Also, we're not stopping any time soon.



But the reason I bring this up is there's one phrase that captures all those things we used to do. No matter what else we might be doing, I can just look him in the eye and say "For freedom". We'll nod, get all solemn, and he'll simply re-affirm.

"For freedom."

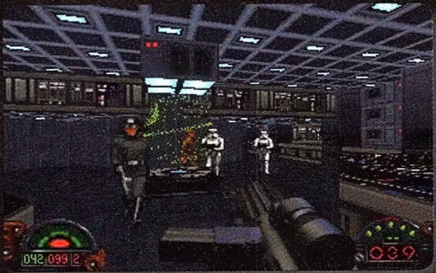
That's one of the many (or, more accurately, few) catch phrases of ex-Imperial Commando and now mercernary operative Kyle Kataarn in the groundbreaking Lucasarts title, Star Wars: Dark Forces. The game only came out in 1995, so it's not even of that venerable generation of titles from the seeming dark ages of gaming, but it seems a long time ago now, especially for me.

When it came out I was in a share house with a mess of student types, my first time out of home, and I didn't even have a PC! Well, I had access to the communal Mac, an old... gosh, I think it was a Power Mac or something. Thankfully, this was also the period when a lot of games came out for both platforms. Mind you, it was bit of a hippy household (I was young!), so there were a couple of folks who really needed to be convinced that a shooter was appropriate for the same system that post-modern thesis was being written on. My only argument was mirrored years later by an excited Ewan McGregor.

"It's f**king Star Wars!"

And, oh my, it was so perfect. This was Lucasarts at their height, in my opinion; the game had so many firsts, from true multi-story level design (impossible in the Doom engine), to interactive music, to access to the Lucasfilm archives for sound effects and more. And it just felt so cool, a lot of which came down to that main character, the embittered Kyle Kataarn.

The great thing about Dark Forces was it slotted so well into the Star Wars canon, while still adding a whole new layer...



In future sequels he goes on to discover his Jedi father, and learn his own force powers, which was kinda cool, but I actually think I preferred him when he was just a guy. Plus he had a great backstory, having fought for the Empire, but then gone rogue when the brutal regime got too much. At the same time, he was way too cool to sign up with the Rebellion, but he'd gladly take their money while taking on missions too tough even for the main characters of the series. The great thing about Dark Forces was it slotted so well into the Star Wars canon, while still adding a whole new layer to the setting.

I have literally lost track of the amount of times I replayed it. It's safe to say that, to this day, it's probably the game I've played to completion more than any other title. And it didn't even have multiplayer!

However, what it did have was a vibrant modding and design community, and a relatively simple toolset. So, yeah, I got lost in this side of things too. As an avid Star Wars roleplayer (using West End's old D6 system, which is far superior to Wizards' more recent D20 efforts – not that I'm some kind of gaming snob... oh, who am I kidding!), the chance to go through all those great sourcebooks, full of things like complete maps and layouts of everything from Imperial cruisers to Rebel bases, and then actually make them in living 3D... it was a geek heaven.

How geeky?

Well, the great thing about the way AI worked in the game was, essentially, every NOC model was a receptacle for a weapon/behaviour. Stormtroopers had blaster rifles, alien thugs had some kind of rapid fire plasma weapon, and so on. But you could swap these around, so that you could have troopers armed with all kinds of stuff. So, of course, I made proper fire teams for my levels; squads with a leader, support weapon troopers, and the like, all modelled off stuff from the RPG.

I'd also like to assure everyone that despite how it sounds, I did in fact have a rich and varied* social life at the time, too.

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*for interesting values of rich and/or varied.

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